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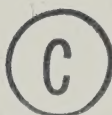
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ELEMENTS OF BRAZILIAN PORTUGUESE PHONOLOGY

by



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A THESIS

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ABSTRACT

Aspects of Brazilian Portuguese phonology are examined in the light of a phonological theory based on the exigencies of language acquisition. The system of phonological rules is considered as an unordered set of output constraints, taken to represent true phonotactic generalizations which the native speaker may be expected to extract from his language, which apply simultaneously to any given form. The primary criterion for posited phonological rules is that they be learnable by the native speaker possessing no intrinsic faculties other than the ability to extract regularity from his environment.

The phenomena discussed concern oral vowels, nasal vowels, and consonants. Particular attention is paid to the process of unstressed vowel raising, and vowel raising during nasalization. The exclusive use of binary distinctive features is questioned as to its ability to accurately characterize several observed phenomena.

The various palatalization and voicing assimilation processes exhibited by the consonants are studied in detail. An attempt is made to analyze the phonemic status of the liquids and the palatal resonants. A section devoted to noun and adjective pluralization compares recent generative phonological treatments with a description based on the surface constraints of the language.

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CHAPTER ONE

A GENERAL INTRODUCTION

1.1. Justification

The Portuguese language as spoken in Brazil provides many unusual linguistic developments which separate it from the other Romance languages and set it apart for special investigation. In particular, the differences which separate Brazilian Portuguese from its nearest typological and geographical neighbor, Latin American Spanish, are far more numerous than the often deceptive similarities. Brazilian Portuguese presents a wide range of vocalic variation, with rising and falling diphthongs further increasing its scope, as well as a complete series of nasal vowels and diphthongs, all of which behave in a manner quite uncommon to any of the other Romance languages. In addition, the Brazilian dialects, particularly the 'carioca' dialect of Rio de Janeiro, exhibit an extensive array of consonantal palatalizations with various determining environments. Still another singularity of the Brazilian dialects of Portuguese is the unusual allophonic variations of the liquids.

The above paragraph has outlined some of the salient features of Brazilian Portuguese which justify a detailed phonological analysis. Elements of the framework of generative phonology, employed here in a substantially modified form, as will be outlined below, can, if handled

cautiously, be utilized to provide a particularly accurate and complete description of a dialect of Brazilian Portuguese, as well as a great deal of insight into the interrelationships and generality of various phenomena characterizing this dialect. The scope of this study is confined to the 'carioca' dialect spoken in and around Rio de Janeiro, taken as a representative of present day Brazilian Portuguese. The phonological rules used to describe this dialect are considered to be valid phonotactic statements of what characterizes an acceptable phonetic sequence rather than as an abstract algorithm through which pass all the phonological representations of a language. In this manner, an empirically satisfying description is attempted which will mirror in some manner the intuition of the native speaker, inasmuch as this can be determined, and which will lend support to the conception of phonological rules as models of true psychological processes.

1.2. The carioca dialect

While the linguistic unity of Brazilian Portuguese is a fiercely debated topic,¹ the existence of various dialects within Brazil is an undeniable fact. Although differing mainly in such areas as vocabulary and intonation, the Brazilian dialects exhibit sufficient phonological and phonetic diversity to warrant the choice of a single dialect for the purposes of a phonological investigation. The carioca dialect, defined as being approximately confined to the Estado de Rio de Janeiro,²

provides the logical choice of a candidate for study, as it is generally considered to constitute the standard for Brazilian Portuguese. It is the dialect most often found in textbooks of Brazilian Portuguese, and is the one most commonly equated by outsiders with the language of Brazil. It has also been adopted by two major Brazilian congresses, the Congresso Brasileiro de Língua Falada no Teatro, and the Congresso Nacional da Língua Cantada, as being the dialect best suited for the needs of a national standard. Its use in this study is also dictated by more pragmatic considerations, it being the dialect of Portuguese with which the author has the greatest familiarity.

1.3. Other relevant studies

At the present time there exists a relatively large body of literature dealing with the phonology of Portuguese. A great number of these studies have dealt with the dialects of Portugal, but Brazilian Portuguese has, especially in recent years, been investigated in several works. This section will briefly mention a few of the more pertinent studies, particularly those explicitly utilized in the present investigation. A more complete description of most relevant studies completed before 1965, including numerous instrumental investigations, may be found in Head (1965: 21-78).

Among the earliest serious studies of Brazilian Portuguese are the works by Hall (1943a, b). Hall investigated the Victoria dialect of the Estado de

Espírito Santo, and his main contribution consists of a more or less complete list of the allophonic possibilities of the various phonemes he encountered. All of his investigation was carried out with a single informant, who was a native of Victoria. Hall's studies contain, in addition to material from this dialect, statements on other Brazilian Portuguese dialects given as hearsay from his informant. For this reason, the detailed accuracy of such a study can be called into question, although most of the data presented concur with later analyses.

At approximately the time of Hall's investigations, a study of the 'paulista' dialect of São Paulo was undertaken by Reed and Leite (1947). Although Miss Leite brought to the study the perception of a native speaker, this work shares the shortcomings of Hall's study in consisting of nothing more than a minimal listing of allophonic variants.

Both the above studies are short, non-detailed accounts of a particular Brazilian Portuguese dialect. A more thorough study, and the most complete phonological analysis of Brazilian Portuguese to be realized by a native speaker, was carried out by Mattoso Câmara (1953). An earlier version of the phonological study appeared in Mattoso Câmara (1949). Arising from the author's doctoral dissertation, the work was based on the colloquial speech of Rio de Janeiro and attempted to present all the segmental phonemes of Brazilian Portuguese

together with an analysis which would permit abstracting the phonemes from among the numerous allophonic variants. A detailed summary of Mattoso Câmara's study, together with some of its later-discovered deficiencies, may be found in Head (1965: 38-40). A notable characteristic of this work is an attempt at achieving a principled economy in the inventory of segmental phonemes by means of rather unusual allophonic rules.

By far the most thorough and complete segmental phonology of Brazilian Portuguese is the contrastive study completed by Head (1965), which deals with the segmental phonology of Rio de Janeiro and Lisbon. This work is extremely valuable in several respects. First, it contains a detailed and critical survey of all previous studies of Portuguese. Second, in the subsequent analysis a large number of substantiating examples is provided. Finally, Head provides an exacting and detailed summary of the phonotactics of the Lisbon and Rio dialects. A further comparison of the phonology of the two dialects in terms of structural dialectology is found in Head (1967).

The studies mentioned above share the common feature of the segmental or autonomous phonemic approach to phonological analysis. The phonemes are elicited from the data by means of substitution, phonetic similarity, and other such criteria. The methodology employed is typified by Head (1965) in a summary of the techniques employed in his study:

Three factors are considered foremost for the classification of two unit segments as members of the same phoneme: distribution, phonetic similarity, and patterning. Two phonetic units are considered members of the same phoneme if they are in complementary distribution or are substitutable in identical environments without an accompanying change of meaning; this is the criterion of greatest importance. (p. 47)

Although Head provides an appendix in which the segmental phonemes of Portuguese are analyzed in terms of Jakobsonian distinctive features (pp. 111-135), neither his study nor any of the others previously mentioned attempt to describe any of the phenomena of Portuguese in terms of these features; the (autonomous) phoneme and its phonetic representations are the smallest units with which these studies are concerned.

Within the comparatively recent framework of generative phonology, treatments of Brazilian Portuguese are extremely scarce, and at the present time no reasonably comprehensive study has been attempted. Saciuk (1970) has presented an interpretation of some Brazilian Portuguese phonological rules, the majority of which deal with vocalic phenomena such as nasalization, vowel raising, and glide formation. A notable characteristic of Saciuk's paper is the heavy dependence on morphophonemic alternations of an erudite nature to establish the abstract lexical representations and to formulate the necessary phonological rules.

The topic of noun pluralization has prompted three works, all dealing with Brazilian Portuguese. St. Clair (1971) relies heavily on the so-called 'stress placement

rule,' a modification of the old Latin stress rule.

Morphophonemic alternations also play a significant part in determining the underlying forms for the analysis of the nasal diphthongs.

The subject of Portuguese pluralization, as formulated by Brasington (1971) has also led to the formulation of some general phonological rules of Brazilian Portuguese. While the rules presented are more numerous and more general in nature than those posited by St. Clair, they are stated merely in terms of alphabetic segments, with no attempt to break the rules down into distinctive features. For this reason, the rules, although set in the format of generative phonology, in reality present no more information than the allophonic statements of the previously mentioned segmental phonemic studies.

The study by Hensey (1968) was intended primarily as an introduction to Brazilian readers of the basic methodology of generative phonology. Hensey acquaints his readers with the techniques of phonological analysis which have since become 'standard' in treatments of Portuguese and Spanish; e.g. positing abstract underlying vowels to generalize a 'stress placement rule.' Hensey's paper is substantially more complete than the other studies on Portuguese pluralization, since it describes many general phenomena as well as treating the rules of pluralization.

Generative phonology has also been applied by Naro (1971a, b, c) to diachronic aspects of Portuguese phonology.

In formulating diachronic rules for Portuguese, Naro has been led to consider synchronic aspects of these same rules, and for this reason his work is in some measure applicable to the present study. Since the emphasis of Naro's work is on interpreting historical data, however, the synchronic rules presented in his papers are of a skeletal and general nature.

1.4. Sources of data

The bulk of the present study is theoretical in nature, and for this reason no extensive field work was undertaken to gather the data presented. All data and examples provided, however, have been personally verified by the author during contact with native speakers of Brazilian Portuguese during the years 1968-71 at Rice University, Houston Texas. Additional primary data was provided by taped material recorded by natives of Rio de Janeiro at the University of Texas at Austin. Some of the observations presented in the following sections are original with the author, but the main part of this study follows generally accepted observations of Brazilian Portuguese.

The main lexical source for Portuguese vocabulary items was Morais Silva's Grande Dicionário da Língua Portuguesa, supplemented by such minor works as Augusto Gonçalves' Dicionário de Estrangeirismos. English translations were verified in Houaiss and Avery's New Appleton Dictionary of the English and Portuguese Languages.

Several standard texts or descriptive studies of

Brazilian Portuguese were employed in addition to those mentioned in the previous section, to verify phonetic and grammatical data. The most important such works were Agard, Lobo and Willis (1944), Vasquez Cuesta (1961), Abréu and Ráneh (1966), and Ellison et. al. (1967). The latter work contains numerous phonetic transcriptions and detailed phonetic statements which were used to verify many of the phonetic descriptions presented in this study.

As a final source of evidence for the data presented in this investigation, several instrumental studies of Portuguese were consulted, the most important being Morais-Barbosa (1963), Lacerda (1958), Lacerda and Hammarström (1952), Lacerda and Head (1962), and Louro (1954). While the present study did not employ instrumental methods of investigation, the ample studies previously undertaken have served to bear out many of the claims presented, particularly as regards nasalization phenomena. A complete listing of works on Portuguese consulted, including many minor studies not mentioned above, is found in the bibliography.

FOOTNOTES

1. Although outsiders to the country generally observe with ease the fact that Brazilian Portuguese is merely a cover term for a group of widely varying dialects, natives of the country often harbor the illusion of a single national language, perhaps as part of the patriotic feeling accompanying independence from Portugal. For a representative treatment of this point of view, see Elia (1961). The topic is treated somewhat more rationally by Silva Neto (n.d., 1950, 1960).
2. A more precise definition and delimitation of the carioca and other dialects of Brazil may be found in Vasquez Cuesta (1961), and Silva Neto (1950, 1960).

CHAPTER TWO

THE THEORETICAL ORIENTATION

2.1. General directions.

This study employs much of the standard notation of generative phonology as found, for example, in Chomsky and Halle (1968) and Harms (1968). The theoretical foundations underlying the ensuing description differ, however, from that of generative phonology in several major aspects. Since it is not the intent of the present investigation to provide a critique of a linguistic theory, but rather to present a description of a particular dialect, only those theoretical points will be explicitly mentioned which have a direct bearing on this study. It is seen, however, that there are few similarities between the theoretical orientation employed in this study and the standard theory of generative grammar. In particular, the theoretical issues raised here concern the intrinsic nature of phonological rules, the abstractness of underlying representations, and the concept of linearly ordered rules.

The model outlined below represents a partial synthesis of two theoretical orientations. The first is the result of a rudimentary statement of purpose originally planned as the introduction to this thesis. This statement was necessitated by the investigator's inability to accept a large portion of the standard methodology of generative

phonology, and was based primarily on descriptive shortcomings of specific analyses of the Portuguese data investigated. The second theoretical orientation represented below comes from the elegant model of language acquisition developed in Derwing (in press) and suggested by Professor Derwing subsequent to the investigation presented in the succeeding chapters. Since the model formulated in Derwing (in press, chap. 6) more than fulfills the goals originally intended for the theoretical introduction to the present study, it will be applied nearly in toto to the Portuguese data and the results will be evaluated in the summary chapter. Only in the (very few) instances where the theoretical inclinations of the present investigator differ from those of Derwing, will any alternative proposals be offered.

2.2 Descriptive preliminaries

The descriptive and abbreviatory devices employed in this study are essentially those found in Harms (1968: 57-76). Slant bars /..../ are used to enclose underlying representations, and phonetic representations are placed within brackets [....]. A further explanation of any other abbreviatory devices will be found in the section in which they are introduced.

For the sake of descriptive simplicity, all coefficients of distinctive features are assumed to be strictly binary. Many serious objections to the principle of binarism have been raised, perhaps the best known has been stated by Martinet (1955: 73-77). Martinet's principal objection

is that insufficient data from all known languages have been accumulated to justify empirically the criterion of binarity. Other studies, for example Contreras (1969) have attempted to invalidate the binarity criterion by means of specific counterexamples. On the other hand, an even larger amount of data (often of questionable relevance) has been presented in favor of strictly binary distinctive features. One such study dealing with the Portuguese vowels is contained in Naro (1971a).

Halle (1957) in a counter-argument to Martinet's statements, has presented the concept of binarism as a scientific working hypothesis, subject at all times to empirical verification, but a hypothesis which need not be rejected until such a time as it be conclusively disproven. Following the latter philosophy, the present investigation has utilized binary features as a descriptive tool adequate for the purposes of this study. At no point in the following sections is sufficient phonetic detail brought forward to warrant the exclusive usage of non-binary features, but no universal claim beyond the scope of this study is made in support of the binarism hypothesis.

2.3 The rule format

Since the inceptions of transformational grammar, the traditional format for rules has been that of the so-called 'rewrite rule,'¹ of the form:

$$A \rightarrow B / X \underline{\quad} Y$$

Phonological rules have commonly been allowed to operate on entire segments, adding, deleting or even replacing them,

all operations which typically involve more than one distinctive feature. The only generally observable tendency is the use of phonological rules has been that they be allowed to apply to only one segment at a time, and even this limitation is often overlooked in practice.

One unfortunate disadvantage of such a restriction is that it requires an extremely large number of rules to be considered as part of the grammar, with each rule operating on only one segment at a time, thus limiting phonological processing a priori to a lengthy chain of simple substitutions rather than allowing for the probability of a smaller set of more complex operations. The rapidity with which even complicated phonological processes are handled by speakers suggests that, if rules are involved in the production of a word, these rules must be more complex and more fast-acting than a string of simple substitution rules.² A specific example is provided by a nasalization process in which one or more vowels followed in the same syllable by a nasal consonant become nasalized, the nasal consonant then being deleted. Such a process is indeed indicated in many speakers of modern Portuguese, as stated elsewhere in this study. Under the restrictions inherent in a system of simple rules, at least two rules would be needed to describe what seems to be a unified and natural process: an iterative rule which nasalizes the appropriate vowels one by one, and a subsequent rule which deletes the nasal consonant. Some investigators have also considered rules of vowel lengthening and

shortening as inherent in the nasalization process.³ Such a description contains, among other things, the notion that each of the intermediate stages represented by successive applications of the various rules possesses some sort of independent existence. Such a claim is denied in the literature by Chomsky and others, but if the stages of a linguistic description are said to possess no reality from the standpoint of the speaker, then by extension the entire description is equally unreal. Postal (1968: 142) speaking of ordered rules states: '... some, in fact most of the rules apply not to the original input forms but to structures at least partially created by previous rule applications.' (emphasis added). The fact that these posited intermediate forms never appear on the surface, however, casts a measure of doubt on their validity.

Although the preceding paragraph has dealt with a specific example, it is exemplary of the sort of descriptive inadequacy which can result from the restriction of a phonological system to a set of individual rules. A satisfactory description of a seemingly unified phonological process is one that would present it in terms of a single rule which would carry out all the necessary changes inherent in the process. A rule of this nature would then be merely an extension of the concept of transformational rules, a notion which is often employed but rarely explicitly discussed. The need for such rules in a phonological description has not been unrecognized in the literature. Chomsky and Halle (1968) admit this possibility in

considering such phenomena as metathesis and contraction:

We must admit into the phonology rules that are most naturally formulated as transformational rules. (p. 360)

A more detailed analysis of the need for phonological rules stated in a transformational format has been given by Langacker (1969):

It has long been recognized that phonological rules must be transformational, at least in the sense that they are sensitive to constituent structure and grammatical classes. Moreover, generative grammarians have always formulated phonological rules in terms of a structure index and an operation, just as transformations are stated—although this is usually obscured by the way in which the rules appear on paper ... the parallel between phonological rules and syntactic transformations is even more extensive, since they perform essentially the same range of operations. Both types of rules add features, modify features, insert elements, delete elements and permute elements. Moreover, a transformational format is needed for certain types of phonological rules, metathesis and contraction rules in particular, and it is desirable to have a single format for all phonological rules. (pp. 857-8)

In undertaking the present study, it has been recognized that in order to provide a description which not only meets formal criteria but also possesses some measure of justification in terms of the observable data, inherently unified processes can only be described by the multiple-change action of transformationally stated rules. A precise definition of 'inherently unified process' is, of course, impossible to obtain.⁴ In practice, however, it has been found that phonological processes tend to follow certain patterns within the language under consideration, defined by such notions as natural classes. For example, few would deny the inherent unity of a process of nasalization

as described above. The present study does not seek to formalize the definition of natural process, but rather provides specific data which in themselves point out various natural subdivisions.

In formulating the rules below, no attempt has been made to employ a so-called 'simplicity metric,' by which term is understood a formal decision procedure which by counting various features and descriptive devices used in writing rules would provide a specific evaluation in terms of their acceptability. The primary motivation for not considering such a proposal is that for the present investigator there exists no verifiable or denumerable relation between the simplicity of a rule in terms of intuition or natural classes and its simplicity as measured by counting arbitrarily invented descriptive devices. The non-arbitrariness of such devices has of course been claimed by Chomsky and others, but is belied in part by the large body of literature in which these conventions are manipulated in various ways to suit the whims of the investigator. Chomsky himself (1965: 39) speaking of simplicity metrics in phonology, states that 'they are internal to specific linguistic theory and their empirical justification relies essentially on this fact.'

A further reason for rejecting such a simplicity metric in the present study lies in the fact that the only concrete proposals made to date on the explicit measures of evaluation of such a metric deal solely with rewrite rules. Even if such a metric possesses empirical validity, it is not

immediately obvious how it could be extended to cover transformational rules of the sort employed here. Since within the framework of transformational rules, a rule may perform an arbitrary number of distinct operations, a method considerably more complex than merely counting features would have to be formulated in order to adequately assess the relative complexity of phonological rules. As mentioned above, there is no a priori relationship between rules stated with maximal simplicity and generality and their actual reality as models of true phonological processes. To date, no conclusive information has been presented which would point to such a connection, and for this reason, the descriptions presented in this study, and the proposed rules which accompany them, strive only to describe in the most complete possible fashion the unified nature of various phenomena in Portuguese.

2.4. The abstractness of base forms

One of the major tenets of generative phonology, and also one of the most controversial, is the concept of abstract underlying forms. In standard practice, it has been permissible to posit underlying forms which are never phonetically realized. Such a premise has naturally led to the proliferation of posited base forms so abstract as to bear little or no resemblance to their surface manifestations. Such a methodology has seemed unsound to many investigators. Kiparsky (1968b), summing up many opinions on the subject, proposed a constraint which he termed the 'alternation condition.' Under this condition, if a given

form always appears in a certain phonetic shape, then this shape must of necessity also be its underlying representation. In response to Kiparsky's proposal, various examples were put forward which indicated that the alternation condition as originally stated might be too strong. In examining synchronic and diachronic evidence from several Polynesian and Australian languages, Hale (1971) has offered the following proposal:

There is a tendency in the acquisition of a language for linguistic forms to be analyzed in a way which minimizes the necessity to posit underlying phonological representations of morphemes which violate the universal surface canonical patterns of the language.

Kiparsky (1971) in a recent paper has reviewed many of the proposals offered concerning the alternation condition and has essentially conceded that in its absolute form it is too restrictive. He has proposed instead that in those instances where an underlying form violates the alternation condition it is to be considered more costly from the standpoint of difficulty in acquisition of the form. Kiparsky further speculates that such forms tend to be learned after words conforming to the alternation condition.

Striving for the same eventual goals as Kiparsky, namely constraints on the lexical representation of forms as well as on phonological rules, Derwing (in press, chap. 6) proposes a model based on the exigencies of language acquisition. Derwing rejects the 'innateness' of linguistic universals as proposed by Chomsky and his followers as an untestable claim closing the door to future research, and

instead considers the only species-specific aspect of language acquisition to be the child's ability to 'extract regularity from his environment.' According to Derwing, the main criterion for a phonological system is that it be learnable. He has attempted to formulate a description utilizing the constraints of both the Jakobsonian and the Chomsky-Halle systems of phonology, while avoiding their major shortcomings. Jakobson's theory placed a strong constraint on the lexical representation of a given form, essentially equivalent to the absolute form of Kiparsky's alternation condition. No specific constraints were placed, however, on the notion of possible phonological rule in this system. In the Chomsky-Halle phonological theory, great care has been taken to constrain the form of phonological rules, but underlying representations have been allowed to assume any form which suits the needs of the proposed description.

Returning to the topic of lexical representations, Derwing's description, since it disallows from the start the idea of innateness of linguistic universals, maintains that the child exposed to the language cannot learn a generalization which is not directly manifested in the data available to him. This does not, however, preclude the possibility of extracting rules for completely predictable phenomena, even in certain cases where phonetically unrealized lexical representations may result. Such is the case with epenthetic e before initial s plus consonant in Portuguese and Spanish. The combination of abstract underlying form

plus rule may be allowed in such cases since the generalization 'e is always supplied in the environment #___sC is objectively true of the primary data to which the Portuguese or Spanish speaking child is exposed and therefore might be extracted or learned by him as a general principle (in this instance as an 'articulatory habit'). Lexical representations are thus restricted to:

1. the set of alternants which actually occur, given specific assumptions about morphological relations among words,
2. those additional representations which are also consistent with the particular system of rules proposed.

Such restrictions are roughly equivalent to the ones proposed (although for different reasons) by Kiparsky (1971). By placing the problem of lexical representation in the light of language acquisition and rejecting the idea that the child can somehow create an internal linguistic system more complex or abstract than that implicit in the data to which he has been exposed, one is on a firmer theoretical foundation. Independent experimental evidence is required, of course, since even in the face of fully regular data the speaker may not be utilizing productive rules at all, but rather storing fully-specified forms in the lexicon. This is eloquently demonstrated, for example, in Hsieh (1970) for tone sandhi in a Chinese dialect.

2.5. Rule ordering

Implicit in all 'standard' formulations of generative phonology is the concept of linearly ordered rules. A clear-cut distinction is generally maintained between morpheme structure (or lexical redundancy) rules and the

phonological rules proper. In most recent studies, the MS rules are considered to constitute an unordered set, generally applying simultaneously or in random order before the P rules. Some implications of considering MS rules to be ordered are considered in Stanley (1967: 407f.) and recapitulated by Chomsky and Halle (1968: 386), the general consensus being that a simpler and more reasonable description results from their being unordered. A linear ordering, or at least a partial ordering, has, however, always been deemed necessary for the P-rules. One explicit formulation of this principle has been put forward by Chomsky (1967), who proposes the following two conditions for all phonological rules:

1. Rules are partially ordered, and no rule applies after a rule that follows it in this partial ordering.
2. Each rule applies to the string resulting from the application of the last rule that has applied.

The only evidence put forward in favor of linearly ordered phonological rules has been in the form of counterexamples to the assumption of non-ordered rules in specific cases. It has been shown elsewhere, for example in Derwing (in press), Koutsoudas (1971a, b) and Koutsoudas, Sanders and Noll (1971) that such arguments usually show only that if the ordering of two particular rules is reversed, incorrect forms will be produced. Not usually considered in such arguments is the possibility that the rules may be applied simultaneously. Koutsoudas has termed this incomplete syllogism the 'strict order fallacy.'

The requirement of linear ordering possesses some descriptive shortcomings. In a comprehensive phonological study, such as Chomsky and Halle (1968) and presumably in any equally detailed phonology of another language, one is presented with a list of phonological rules whose number can extend into the hundreds. For example, Postal (1968: 151) refers to a particular set of six ordered rules in Mohawk as 'a tiny fragment of the total class of ordered rules in Mohawk phonology.' While only a relatively small subset of all the possible rules generally applies to any given lexical item, this item is bound by the linear ordering requirements to pass through each rule in turn, being modified or remaining unchanged depending on the rule involved. In particular, taking such a phonological description to model in some way the psychological processes involved in speech would seem to require the mind to store an unworkably large number of intermediate representations of each underlying form, none of which are ever phonetically realized. Even allowing the phonological rules to take the form of transformations capable of performing multiple operations would necessitate a large number of retained intermediate forms. While it has been adequately demonstrated that a system of ordered rules can, if sufficient rules are formulated, arrive at the correct phonetic representation of an abstract base form posited in almost any conceivable fashion, the adoption of such a description as a model of a cognitive process leads to highly counterintuitive results, as stated above.⁵

A possible alternative to the criterion of strictly ordered rules has been mentioned in passing by Vennemann (1970). In dealing with the case in German where /n/ velarizes before a velar consonant, with the velar consonant subsequently dropping to yield [ŋ] he proposes that the two processes could be considered as:

members of an unordered set of rules subject to the convention that rules are applied in random order over and over again until no changes are effected by this procedure any more. (p. 67)

However, while overcoming the theoretical obstacle of ordered rules, such a description still requires the consideration of as many intermediate representations as there are rules involved, which still presents a stumbling block if very many rules are involved.

Chafe (1968) attempts to surmount some of the problems inherent in a large number of ordered rules. Using the concept of 'depth' of ordering to mean the distance in terms of number of rules required to map between an underlying form and its phonetic representation, Chafe has proposed that rules tend to be ordered so as to minimize depth of ordering and so as to maximize simultaneous ordering (p. 127).

Derwing (in press) has carried this proposal to its logical extreme. In his model, there is no rule ordering at all; in general, all rules apply simultaneously. This fact follows from the definition offered by Derwing of a phonological rule. As mentioned above, the main criterion to be met by a phonological rule in Derwing's model is that

it be learnable, that it must directly characterize the data to which the child learning the language is exposed. Following this argument, one important class of phonological rules is considered to include those which are true phonotactic generalizations about the language, and which can be construed as representing valid articulatory habits possessed by the speaker. Such articulatory habits or phonotactic generalizations carry with them a range of non-permissible phonotactic sequences which will be automatically rejected. Thus the rules serve as a set of output constraints, learned through endless repetition of certain sequences. More specifically, Derwing has envisaged each such rule to consist of two parts. The first is a statement of the particular 'impossible' sequences which the articulatory habit has produced; the second is the particular 'instruction' to be carried out whenever a form is drawn from the lexicon containing such a sequence. Such a system of rules considered as output constraints or articulatory habits may then apply simultaneously to a given form in the following fashion: A form X is scanned by all output constraints to determine if all constraints are met. If they are, the form is phonetically produced, of they are not; i.e. if the form includes one or more 'impossible' sequences, the special instructions contained in the appropriate rules are carried out. The form is then scanned once again by the entire set of output constraints, to insure complete conformity. If this has been achieved, the form is produced, if not, the proper rules apply as before.

This process continues until the form in question satisfies all output conditions.⁶

A model of rule application such as the one proposed by Derwing and outlined above rejects the need for extrinsically ordered rules. However, since the entire set of output constraints may act on a given form several times in order to produce an acceptable output, one must still consider in certain cases a number of non-produced intermediate forms. Due to the strict constraints placed on both possible rules and possible lexical representations in Derwing's model, it is hoped that the number of intermediate forms will not exceed the bounds of feasibility in any instance.

Given the concept of an unordered set of output constraints there is a slightly different possible interpretation as to how they might apply to a given form, at least in some languages. In section 2.3 it was argued that apparently unified processes should be combined, whenever feasible, into a single rule or group of closely related rules. Using such a notion, one may consider the set of output constraints to possess a certain degree of internal structure. This set of constraints may be considered to be divided into (perhaps overlapping) blocks, where each block consists of one or more rules inherently related to the same process. As mentioned previously, it is probably impossible to rigorously define what constitutes a related set of rules. One must turn instead to specific data for a possible answer. In the Portuguese data presented in

the following chapters, certain natural subdivisions manifest themselves rather clearly.

Continuing this line of thought, one may consider all blocks applying simultaneously to a given form. If some of the output constraints are not met, the appropriate blocks of rules apply. If, after the application of these blocks, all the output constraints are still not satisfied, further rules from the same blocks then apply. This processes continues until the acceptable forms are produced. Such a proposition encounters the problem of rule 'conspiracies' discussed in Kisseberth (1970) and elsewhere, where seemingly unrelated rules conspire to eliminate the same class of non-permitted sequences. Since the remarks contained above are purely speculative, no attempt will be made to analyze the notion of rule conspiracies. It is possible, however, that if rule conspiracies represent true psychological processes then the apparently unrelated rules may be psychologically grouped into the same block. Another possibility is that certain rules apparently involved in several conspiracies may actually exist in several independent blocks, due to their interrelatedness with a diverse set of phenomena. On the other hand, if rule conspiracies do not possess psychological reality, then they are merely fortuitous observations and deserve no place in a linguistic theory.

The proposal just mentioned has the possible advantage that only a portion of the set of output constraints need apply to a given form past the initial scanning. It is as yet purely speculative, however, and must await further

work in the area of psycholinguistics. It has been included since it is consistent both with Derwing's criteria for phonological systems and with the observed Portuguese data given in the following chapters.

A further remark must be made at this point about the place of application of rules. In earlier formulations it was assumed that redundancy rules or morpheme structure rules applied only to underlying forms at the systematic phonemic level, while true phonological rules mapped between different levels of representation.⁷ Implicit in these discussions was the assumption that considerable variation might exist between the lexical and phonetic levels of representation. In the model proposed by Derwing (in press) however, very little deviation is permitted between the two levels. In this model, therefore, the distinction between MS rules and P rules vanishes, all phonotactic rules being conceived as related to the surface or phonetic level. Thus, the concept of redundancy conditions filling in features at a deep underlying level of representation is abandoned.

FOOTNOTES

1. For example Lightner (1971: 499-500).
2. See Menyuk (1971: 23).
3. For example, St. Clair (1971: 97f.).
4. An attempt in this direction may be found in Schane (undated).
5. Derwing also points out many serious methodological and metatheoretical difficulties inherent in this approach (chaps. 4 and 5).
6. Koutsoudas (1971b) has briefly mentioned this possibility.
7. For example Harms (1968: 84-5), Stanley (1967: 394).

CHAPTER THREE

THE ORAL VOWELS

3.1. General description

Brazilian Portuguese has basically the following simple oral vocalic segments: [i] , [e], [ɛ] , [a], [ɐ] , [ɔ] , [o], and [u]. With the exception of [ɐ] these segments may all enter into phonemic oppositions, as indicated by the following examples, taken from Head (1965: 83):

<u>vila</u>	[víle]	'town'
<u>ve-la</u>	[véle]	'he sees her'
<u>vêla</u>	[vêle]	'candle'
<u>vala</u>	[vále]	'ditch'
<u>suco</u>	[súku]	'juice'
<u>sôco</u>	[sóku]	'blow with the fist'
<u>soco</u>	[sóku]	'I strike'
<u>saco</u>	[sáku]	'sack'

Traditionally, Portuguese has conserved a minimal phonemic distinction between [a] and [ɐ] in the first person plural forms of the preterite tense of verbs in -ar. Such a distinction was maintained in such pairs as:

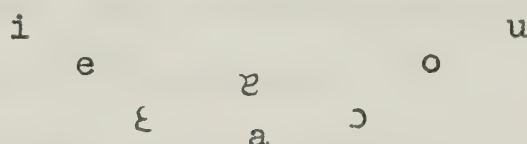
<u>mandamos</u>	[mẽdẽmus]	'we order'
<u>mandámos</u>	[mẽdãmus]	'we ordered'

It was this distinction in a single class of forms which has served to maintain a phonemic distinction between /a/ and /ɐ/, since in other circumstances, only /a/ is found orally in stressed position, while [ɐ] occurs only in unstressed oral form or as a nasal variant of /a/. The above distinction, while currently maintained in Iberian Portuguese,¹ has generally disappeared from the informal speech of the carioca dialect, as well as from the other

dialects of Brazil,² and the end result in both the present and preterite forms is the nasalized phone [ẽ].

<u>falamos</u>	[fɐ lɐ̃ mus]	'we speak'
<u>falámos</u>	[fɐ lɐ̃ mus]	'we spoke'

While no longer occupying phonemic status in Brazilian Portuguese, the phone [ẽ] still occurs as an unstressed variant of /a/, as well as in its nasalized form. Therefore, it must be fitted into the total description of the Brazilian Portuguese vocalic segments. There has been some controversy, however, as to the exact position of [ẽ] among the other Portuguese vowels. Most traditional studies have considered [ẽ] as a central vowel, somewhat higher than /a/. Such a vocalic is represented as:



However Mattoso Câmara (1953: 70) has considered [ẽ] to be a low vowel, somewhat 'posterior' to /a/, while Louro (1954) considers the phones [ẽ] and [a] to be articulated farther back than the 'back' vowels /u/, /o/, and /ɔ/. More recent instrumental analyses of Portuguese have reaffirmed the segment [ẽ] as a central vowel, somewhat higher than /a/.³ The results of these studies also concur with the impression of the present investigator that [ẽ] is a raised central vowel with a somewhat variable degree of aperture. The above schematization of the Brazilian Portuguese vowels is therefore reasonably accurate, and the description proposed below will reflect a vocalic system so depicted.

3.2. The distinctive features

In formulating a phonology of Brazilian Portuguese, a language with a rich variety of vowels and consonants and their respective variants, the choice of a meaningful and workable set of distinctive features becomes more than just an arbitrary decision. Various complete and tentatively universal sets of distinctive features have been proposed, each with emphasis on a different descriptive aspect, and each motivated by observations based on a particular group of languages. As a basic tenet of modern phonological theory, the coefficients of these features at the underlying level are taken to be binary, as mentioned in Chapter Two, but no agreement on the exact nature of the features has been reached. It is the goal of the present investigation to describe various phenomena peculiar to Brazilian Portuguese in relation to their phonological and phonetic representation. For this reason, a set of features must be chosen which will describe segments with sufficient accuracy to enable the formulation of a reasonably adequate heuristic presentation based on these features. While the distinctive features commonly employed do not provide fine phonetic or articulatory detail, they can, if chosen judiciously, provide a description which is accurate in its major aspects. There are, of course, no exact methods for determining the most accurate or adequate set of features, one must instead strive for a balance between simplicity and accuracy. Such a balance is attempted in the remainder of this section. The term 'distinctive'

A new set of distinctive features for vowels has been proposed by Chomsky and Halle (1968), and extrapolating from their descriptions of English leads to the following feature specifications for the Portuguese vowels:

	<u>i</u>	<u>e</u>	<u>ɛ</u>	<u>a</u>	<u>ɐ</u>	<u>ɔ</u>	<u>o</u>	<u>u</u>
high	+	-	-	-	-	-	-	+
low	-	-	+	+	-	+	-	-
back	-	-	-	+	+	+	+	+
round	-	-	-	-	-	+	+	+

A formulation of this nature represents the Portuguese vowel system as:

i	u
e	ɐ/o
ɛ	a/ɔ

In this representation, the pairs of vowels [ɐ] : [o] and [a] : [ɔ] are presented as having the same place of articulation, differing only in rounding, which is far removed from the actual facts. Another shortcoming of such a description is that only three degrees of aperture are allowed, and only the distinction front-back is presented, with the feature 'round' doing double duty to provide the front-to-back specifications.

Another means of representing the Portuguese is the one utilized by Lüdtke, and, in modified form, by Naro (1971a). Using the features low, high, back, and front, gives the following specifications:

	<u>i</u>	<u>e</u>	<u>ɛ</u>	<u>a</u>	<u>ɐ</u>	<u>ɔ</u>	<u>o</u>	<u>u</u>
low	-	-	+	+	-	+	-	-
high	+	-	-	-	-	-	-	+
back	-	-	-	-	-	+	+	+
front	+	+	+	-	-	-	-	-

This description yields a square vocalic system, with three degrees of aperture and three points on the front-back scale:

i		u
e	ɐ	o
ɛ	a	ɔ

Although this is the most accurate representation offered so far, it shares with the preceding ones an unrealistic presentation of the actual nature of the Portuguese vocalic system. The phone [ɐ] is distinctively lower than /e/ and /o/, as well as being more open than /a/.⁴

Harms (1967) dealing with the Permic vowel systems, has argued for the implementation of a feature such as 'central' (in his work 'peripheral') to set off the central and peripheral vowels as natural classes. A modified version of Harms' proposal, using the feature central, describes the Portuguese vowels as:

	<u>i</u>	<u>e</u>	<u>ɛ</u>	<u>a</u>	<u>ɐ</u>	<u>ɔ</u>	<u>o</u>	<u>u</u>
central	-	-	+	+	+	+	-	-
high	+	-	-	-	+	-	-	+
low	-	-	-	+	-	-	-	-
back	-	-	-	-	-	+	+	+

There are some apparent advantages to be realized from a presentation of this nature. First, the peripheral vowels e and o, which are the vowels commonly thought to undergo unstressed vowel raising, are set apart from the central vowels. It will be shown later, however, that this is a false assumption. In addition, specifying [ɛ] and [ɔ] as +central more nearly portrays the triangular nature of the Portuguese vowel system. However, in order to obtain a

consistent set of features one is forced to represent [ɐ] as [+high], which is generally far removed from the actual situation. The above set of specifications represents a vowel system portrayed as:

i	ɐ	u
e	ɛ	o
	a	

Such a portrayal, while having some descriptive points in its favor, is, taken as a whole, an entirely inadequate representation.

It becomes obvious in examining the previous proposed descriptions that four separate distinctive features are needed to fully specify all the Portuguese oral vocalic segments. The ideal set of features would provide for four degrees of aperture and at least three points on the front-to-back axis. Kiparsky (1968a: 186) studying a Swiss German dialect reputed to have four distinctive degrees of tongue height in the front vowel series, has proposed the employment of a feature 'mid.' Adapting the use of this feature to the Brazilian Portuguese vocalic system results in the following matrix:

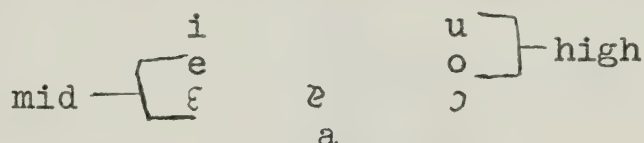
	<u>i</u>	<u>e</u>	<u>ɛ</u>	<u>a</u>	<u>ɐ</u>	<u>ɔ</u>	<u>ə</u>	<u>u</u>
high	+	+	-	-	-	-	+	+
mid	-	+	+	-	+	+	+	-
back	-	-	-	-	-	+	+	+
front	+	+	+	-	-	-	-	-

This corresponds to a vowel system represented as:

i		u
e		o
ɛ	ɐ	ɔ
	a	

This description schematically corresponds very closely

with the actually observable system of Brazilian Portuguese. Objections are sometimes raised to this sort of presentation however, since it presents /e/ and /o/ as specified +high and +mid. Chomsky and Halle (1968: 305) in presenting their revised set of distinctive features for vowels, rule out the similar-appearing possibility of a segment being both +high and +low, since the tongue cannot be simultaneously above and below its normal rest position. The application of a similar argument to the description offered above, however, is misleading, since the features 'high' and 'mid' do not refer explicitly to the position of the tongue, but rather constitute a partitioning of the vertical axis into partially overlapping segments:



In this manner, a segment may be unambiguously specified +high and +mid.

In view of the preceding discussion, it appears that the set of distinctive features just proposed most accurately and realistically describe the Brazilian Portuguese vowel system, and as a consequence these features will be employed in the remainder of this study.

3.3. Stress placement

The present study is primarily limited to segmental phenomena of Brazilian Portuguese, and for this reason the problem of stress placement will not be extensively dealt with. However, since the concept of stress appears in many

of the descriptions offered below, some clarification is necessary at this point. In keeping with the theoretical considerations set forth in Chapter Two, stress will be examined on the basis of its surface manifestations. A complete treatment of Brazilian Portuguese stress placement from a more abstract point of view, including the concept of phonetically unrealized base forms, may be found in Agard (1967: 166-79). Briefer mention of the problem may also be found in Saciuk (1970), St. Clair (1971), Hensey (1968) and Brasington (1971).

The first point to be noticed is that stress placement is clearly a phonemic phenomena in Brazilian Portuguese, as exemplified by the following minimal pairs:

<u>dúvida</u>	'doubt'
<u>duvida</u>	'he doubts'
<u>divide</u>	'he divides'
<u>dividi</u>	'I divided'

Although minimal pairs such as the ones illustrated above are comparatively rare, the position of stress may vary over the final, penultimate or antipenultimate syllables. Without recourse to a description allowing for the positing of totally abstract underlying forms which do not reflect the surface observations, there seem to be relatively few instances where the stress in a Brazilian Portuguese word can be accurately predicted from its surface form. This section will outline the partially predictable cases; a more complete listing, although with a much different interpretation, may be found in Agard (1967: 168-9).

As a general rule, nouns and adjectives of more than

one syllable receive stress on the penultimate syllable:

<u>cidade</u>	'city'
<u>boa</u>	'good (f.)'

Stress may also occur on the antipenultimate or final syllables. In these instances, stress is generally indicated in the orthography by a diacritic:

<u>café</u>	'coffee'
<u>química</u>	'chemistry'

Nouns, adjectives and adverbs ending in a consonant regularly take the stress on the final syllable.

<u>rapaz</u>	'boy'
<u>fuzil</u>	'rifle'
<u>favor</u>	'favor'
<u>jamais</u>	'never'

There are exceptions, however, and these exceptions are generally also exceptions to other more general phenomena such as pluralization, as will be shown later. Stress placements in these exceptional cases is also indicated in the orthography:

<u>lápiz</u>	'pencil'
<u>automóvil</u>	'automobile'

This also applies to the infinitive form of verbs, which end in -r; and stress the final syllable:

<u>jantar</u>	'to eat'
<u>dizer</u>	'to say'

A certain regularity of stress placement also exists among the various verb tense endings. A complete account of these facts may be found in Eastlack (1965).

The very skeletal presentation above shows that, except for some amount of regularity in the class of words ending in a consonant, stress placement in Brazilian

Portuguese is largely conditioned along morphological lines. Except in the above mentioned cases, there seems to be no method of predicting the stress placement of a word without positing various abstract underlying forms, or without reference to grammatical functions. For the majority of cases, it appears necessary, at least within the framework utilized in the present investigation, to consider word stress to be a lexical feature. It is perhaps instructive to consider a statement on stress placement taken from the textbook of Agard, Lobo and Willis (1944: 14):

The stressed or strong syllable in a Portuguese word is, we repeat, fixed by tradition. As in English, the stress must be learned with each word. The stressed syllable may (depending on the word in question) be any of the last three.

Recent generative phonological studies of Portuguese have attempted to circumvent this fact by positing underlying vowels which 'level out' the prediction of word stress. Such a tactic is inconsistent with the theoretical premises of this study, since it is highly unlikely that a child learning the language will consider underlying vowels which he has never heard.

The lexical feature of stress is present in derivational and inflectional endings as well as in base morphemes. In the case of nouns, adjectives and adverbs ending in a consonant, stress placement is regular enough to be considered predictable by the following rule:

(1) $V \rightarrow [+stress] / ______ ([-cons]) C\#$

The provision -cons is added to include words ending in a diphthong plus consonant, such as mais, jamais, etc. This

phenomenon is valid for all grammatical classes.

For the purposes of the present investigation, word stress in Brazilian Portuguese will be considered as a lexical feature, except in those cases where rule (1) applies. It will then be necessary to consider the stress placement rule (1) to operate before any other rule depending on stress, such as the unstressed vowel raising rules described below.

3.4. Unstressed vowel raising

Most traditional descriptions of Portuguese contain a statement to the effect that final orthographic o becomes raised to u and that final orthographic e becomes raised to i, when these vowels are unstressed. Quite often an additional remark is made as regards the sporadic occurrence of this phenomena in other unstressed positions. In a few relatively complete treatments of Portuguese phonology one can even find a description of the raising of orthographic a to e in unstressed position. The present section will examine the accuracy and validity of such a description in terms of the phonological structure of modern Brazilian Portuguese.

3.4.1. Historical developments. Historically, the orthography of the Portuguese vowels appears to have conformed by and large with the pronunciation; i.e. orthographic e always represented [e] and orthographic o always stood for [o]. At some point in time, which has not been precisely determined,⁵ the pronunciation of final atonic o shifted toward [u] and the pronunciation of atonic e shifted toward [i], perhaps as a result of a decrease in articulatory

energy.⁶ According to Naro (1971c) and Herculano de Carvalho (1962), the shift of final unstressed o to [u] occurred significantly before the shift of unstressed e to [i]. The former process can be considered formally as the addition to Portuguese of a rule such as:

$$(2) \quad \left[\begin{array}{c} V \\ +back \\ +mid \\ -stress \end{array} \right] > \left[\begin{array}{c} +high \\ -mid \end{array} \right] / _____\#$$

In Iberian Portuguese (but not, according to Naro (1971c) in Brazilian Portuguese), rule (2) subsequently became generalized to its mirror-image form, with vowel raising taking place on either side of the tonic syllable:⁷

$$(3) \quad \left[\begin{array}{c} V \\ +back \\ +mid \\ -stress \end{array} \right] > \left[\begin{array}{c} +high \\ -mid \end{array} \right] / \#$$

Actually, rule (3) must be modified, at least in the case of Iberian Portuguese, to include all unstressed positions, even those more than one syllable removed from the tonic syllable. Such a further generalization is necessary in order to account for the often-heard pronunciation in both Iberian and Brazilian Portuguese of forms like:

colocar [kulukár] 'to place'

A revised version of rule (3) in its most general form, would be:

$$(4) \quad \left[\begin{array}{c} V \\ +back \\ +mid \\ -stress \end{array} \right] > \left[\begin{array}{c} +high \\ -mid \end{array} \right]$$

The history of the raising of unstressed e to [i] appears to have taken a somewhat different course from the

process described above. Naro (1971c) taking his evidence from early descriptions of various Portuguese dialects, normative statements of grammarians, and apparently phonetically motivated orthographic errors, indicates that the first instances of raising of unstressed e occurred in initial position, under the influence of a tendency to nasalize e in this position. The nasalization was subsequently lost, and the result, apparently general throughout the Portuguese-speaking world, was a rule of the form:

$$(5) \quad \left[\begin{array}{c} \text{v} \\ +\text{front} \\ +\text{high} \\ +\text{mid} \\ -\text{stress} \end{array} \right] \rightarrow [-\text{mid}] / \# \underline{\quad}$$

This rule was later generalized, evidently by different paths and at different times in the various separated Portuguese dialects, to its mirror-image form:

$$(6) \quad \left[\begin{array}{c} \text{v} \\ +\text{front} \\ +\text{high} \\ +\text{mid} \end{array} \right] \rightarrow [-\text{mid}] / \# \left[\begin{array}{c} \underline{\quad} \\ -\text{stress} \end{array} \right]$$

In Brazilian Portuguese, for reasons to be discussed shortly, one can postulate a further generalization of rule (6) to include all unstressed occurrences of e, which would account for often heard Brazilian forms such as:

<u>desejar</u>	[dizižár]	'to desire'
<u>testemunhar</u>	[tèstimunár]	'to testify'

A generalization of rule (6) would be of the form:

$$(7) \quad \left[\begin{array}{c} \text{v} \\ +\text{front} \\ +\text{high} \\ +\text{mid} \end{array} \right] \rightarrow [-\text{mid}] / \left[\begin{array}{c} \underline{\quad} \\ -\text{stress} \end{array} \right]$$

A comparison of rule (7) with rule (4) shows that once

both rules may be considered productive in Brazilian Portuguese, a further generalization is possible which will include the raising of all non-central vowels in unstressed position. Before proceeding further, however, it must be noted that, at least in the case of the Iberian and Brazilian dialects of Portuguese, the historical evolution does not appear to point to a straightforward generalization of the above rules. Instead, the generalization of unstressed vowel raising to include the passage of e to [i] seems to have followed various complex routes in the various Portuguese dialects, involving among other things, nasalization and confusion of prefixes. It is possible that an underlying tendency to generalize the process already firmly established in one position to include all unstressed positions played a part in the generalization of unstressed vowel raising in the various Portuguese dialects, but such a tendency must not be confused with a straightforward process of rule generalization (cf. Naro 1971c). Leaving aside the question of how the generalization was effected, one may, in the case of Brazilian Portuguese, propose the following generalization of rules (4) and (7) to include raising of all peripheral vowels in non-stressed position:

$$(8) \quad \left[\begin{array}{c} v \\ +\text{high} \\ +\text{mid} \\ -\text{stress} \end{array} \right] \rightarrow [-\text{mid}]$$

A rule such as (8) seems to have once been fully productive in the Ceylon dialects of Portuguese,⁸ and is applicable

in the case of Brazilian Portuguese to an extent which will be described below.

To date, no attempt has been made to trace the historical development of Portuguese unstressed a to[ɐ] . A possible reason for this lack of information may lie in the fact that historical developments of a language are often traced by means of variations in the orthography of old documents. In the case of the raising of unstressed o and e to [u] and [i], one can discover an ample number of examples of orthographic i for etymological e and of orthographic u for etymological o. In the case of the shift of unstressed a to[ɐ] , however, no ready orthographic symbol was available which could adequately describe the sound of [ɐ] , and such a gap may be partially responsible for the general lack of knowledge on this change. Since the nasalized allophone of /a/ is [ã], one can speculate as to a possible historical connection between the raising of unstressed /a/ and the nasalization of /a/. It is also possible that unstressed a was pronounced [ɐ] even in the earliest stages of Portuguese (cf. Williams 1962: 40). Returning to the case of Brazilian Portuguese, one may state that at some point a rule was introduced, the reason at present unknown, which generally raised unstressed a to[ɐ]:

$$(9) \quad \left[\begin{array}{l} \text{v} \\ \text{-front} \\ \text{-back} \\ \text{-stress} \end{array} \right] > [+mid]$$

Comparing rule (9) with rule (8) which generally raised

unstressed peripheral vowels, a further generalization is possible, which will describe at one time all the raising of vowels in unstressed position:

<u>e</u>	>	[i]
<u>o</u>	>	[u]
<u>a</u>	>	[e]

It must again be emphasized that such a generalization is not to be construed as a description of the course of history, but rather as a generalization to a unitary process of phenomena which developed along distinct paths. Bearing this caution in mind, one may propose the following general rule of unstressed vowel raising in Brazilian Portuguese:

$$(10) \quad \left[\begin{array}{c} V \\ \alpha_{\text{high}} \end{array} \right] > [-\alpha_{\text{mid}}] / \left[\begin{array}{c} \text{---} \\ -\text{stress} \end{array} \right]$$

The previous paragraphs have dealt with certain historical aspects of unstressed vowel raising which affected the system of Brazilian Portuguese, culminating with a single general rule, given in (10), which provides the end result of several diverse processes.

3.4.2. The present situation. It remains now to determine whether the historical processes depicted by (10) are still active in modern Brazilian Portuguese. In order for this to be determined, it will be necessary to examine the present status of unstressed vowels in the carioca dialect.

In the carioca dialect, the shift of unaccented a to [e] is virtually complete; that is, in unstressed position only [e] is generally heard. The raising of unstressed e and o is general in final, posttonic, and pretonic positions.

The major vacillations to be found occur mainly in cases where there is more than one pretonic syllable. It is also to be noted that in words of four or more syllables, a secondary accent usually prevents raising of this syllable:

acrescentar [ɐkrèsẽtár] 'to add'

The above-mentioned vacillations in the raising of unstressed vowels are for the most part totally sporadic, varying both within the dialect and within the individual idiolects. A noted exception to this lack of generality is the case of the irregular plural of nouns and adjectives ending in unstressed -il. These words form their plurals as illustrated below:

<u>automóvil</u>	[awtumóviw]	'automobile'
<u>automóveis</u>	[awtumóvejs]	'automobiles'
<u>fácil</u>	[fásiw]	'easy (s.)'
<u>fáceis</u>	[fásejs]	'easy (pl.)'

In these cases, the mid vowel /e/ occurs in the unstressed diphthong [ej]. Words of this class are quite rare and are considered irregular by native speakers. In fact, one can at times hear, in careless or uncultured speech, a leveling tendency which produces such forms as *automóvis, *fácis, etc. This is in keeping with the pluralization of nouns and adjectives ending in stressed -il:

<u>barril-barrís</u>	'barrel(s)'
<u>fusil-fusís</u>	'rifle(s)'

The occurrence of the diphthong [ej] in unstressed position will be discussed further in the following chapter.

It has been noticed that, except in cases of the

irregular plurals mentioned above, unaccented e has raised to [i] and unaccented o has raised to [u] , with the additional exception of some sporadic cases. Furthermore, Brazilian Portuguese, at least in the carioca dialect with which the present investigator is familiar, gives the impression of being in the process of carrying this raising tendency to full completion (cf. Mattoso Câmara 1957: 280). One reason for this tendency is the development of an increasingly strong expiratory stress accent, which assigns even less articulatory energy to the unstressed syllables than ever before, and hence reduces these vowels to the greatest extent possible. In view of these facts, it seems legitimate to state that as a general rule, in unstressed position, Brazilian Portuguese vowels occur only in their raised forms. In such cases, the underlying vowels need only be specified as to frontness or backness, since the other features are redundantly predictable. In other words, unstressed vowels in underlying form are specified in one of three ways:

[+front]	[-front]	[+back]
	[-back]	

A pair of redundancy statements then fill in the remaining features:

$$(11) \quad \begin{bmatrix} V \\ \alpha \text{ front} \\ -\alpha \text{ back} \\ -\text{stress} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{high} \\ -\text{mid} \end{bmatrix}$$

$$(12) \quad \begin{bmatrix} V \\ -\text{front} \\ -\text{back} \\ -\text{stress} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{high} \\ +\text{mid} \end{bmatrix}$$

The fact that there appears to be no neat way of compressing

(11) and (12) into a single, more general appearing rule can be attributed in part to the choice of distinctive features. As mentioned earlier, no attempt has been made to achieve maximum rule simplicity in terms of the formal structure; rather, the most accurate description has been sought after. In fact, there is reason to consider the two processes described in (11) and (12) as somehow separate, owing both to historical facts and to the varying degrees of generality with which they apply to contemporary Brazilian Portuguese. Rule (12) appears primarily motivated by considerations of articulatory energy, while rule (11) seems to be the end result of a generalization to all unstressed positions of rules which were initially valid only in a single position.

While rules (11) and (12) cover the majority of cases in Brazilian Portuguese where unstressed vowels are redundantly predictable, there are also cases in the language where a need exists to posit fully specified underlying vowels in unstressed position. These cases are primarily those arising from a shift of stress in derivational or inflectional forms. Examples of the alternation of [a] with [ɐ] are as follows:

<u>falar</u>	[fɛlár]	'to speak'
<u>fala</u>	[fálɐ]	'he speaks'
<u>tomar</u>	[tumár]	'to take'
<u>toma</u>	[tómɐ]	'he takes'
<u>chega</u>	[šégɐ]	'he arrives'
<u>chegada</u>	[šigádɐ]	'arrival'
<u>xingar</u>	[šígár]	'to abuse'
<u>xingador</u>	[šígədór]	'abusive'

To account for such alternations of [a] with [ɛ] a rule is needed of the form:

$$(13) \quad \begin{bmatrix} V \\ -\text{high} \\ -\text{mid} \\ -\text{stress} \end{bmatrix} \rightarrow [+mid]$$

Occurrences of the alternation of [e] with [i] are typified by the following examples:

<u>comer</u>	[kumér]	'to eat'
<u>come</u>	[kómi]	'he eats'
<u>cena</u>	[séne]	'scene'
<u>cenario</u>	[sinárju]	'scenery'
<u>poder</u>	[pudér]	'to be able'
<u>pode</u>	[pód'i]	'he is able'
<u>acontecer</u>	[ɛ kót'isér]	'to happen'
<u>acontecimento</u>	[ɛ kót'isimétu]	'event'

These examples require the presence of the following rule:

$$(14) \quad \begin{bmatrix} V \\ +\text{front} \\ +\text{high} \\ +\text{mid} \\ -\text{stress} \end{bmatrix} \rightarrow [-mid]$$

[o] alternates with [u] in instances such as:

<u>incorporar</u>	[íkòrpurár]	'to incorporate'
<u>incorporo</u>	[íkurpóru]	'I incorporate'
<u>local</u>	[lukáw]	'local'
<u>localismo</u>	[lòkalíizmu]	'localism'
<u>tomar</u>	[tumár]	'to take'
<u>toma</u>	[tómɛ]	'he takes'

These alternations call for the following rule:

$$(15) \quad \begin{bmatrix} V \\ +\text{back} \\ +\text{high} \\ +\text{mid} \\ -\text{stress} \end{bmatrix} \rightarrow [-mid]$$

It can be seen that rules (13), (14) and (15) can be compressed into a single rule which would take account of

all the alternations presented thus far. Such an all-encompassing rule would take the form:

$$(16) \quad \left[\begin{array}{c} \text{v} \\ \text{α high} \\ \text{-stress} \end{array} \right] \rightarrow [-\text{amid}]$$

It will be noticed that rules (13), (14), (15) and (16) are equivalent to the historical rules (9), (7), (4) and (10), respectively. In particular, rule (16) is equivalent to the maximal generalization of the historical process which was assumed to have affected the Brazilian Portuguese unstressed vowels. While it does not appear that the historical processes evolved directly as a generalization toward a single rule such as (16), the generalized form of the historical processes appears to have survived synchronically as a rule in Brazilian Portuguese. It has been shown, then, that in the majority of cases, the historical rules which raised unstressed vowels in the Brazilian dialects have eliminated optional variation in pronunciation and the residue of these rules takes the form of redundancy conditions on the modern vowel system. In certain cases, however, there has been seen to be a need to posit fully specified underlying vowels in unstressed position of root morphemes, and in these cases a reflection of the historical processes can be seen.

The above-mentioned cases of vowel raising are the ones most commonly dealt with in descriptions of Brazilian Portuguese. However, the phonemic vowels of the carioca dialect include not only /i/, /e/, /a/, /o/ and /u/, the vowels with which the preceding paragraphs have dealt,

but also the two open mid vowels /ɛ/ and /ɔ/. Since these two latter vowels are specified as -high and +mid, they are raised together with /e/ and /o/ in rules (11) and (12) and remain unchanged in a rule such as (16). Since neither [ɛ] nor [ɔ] occurs in unstressed position in Portuguese, the above description may seem to adequately handle the facts. However, the fact that rule (16) does not raise underlying /ɛ/ and /ɔ/ results in an incomplete and misleading description.

Brazilian Portuguese employs a number of suffixes to form diminutives of nouns and adjectives (and, in certain cases adverbs). The most common diminutive suffix, and the only one currently productive, is -inho [ĩnu] together with its variant -zinho [zínu]. The first syllable of this diminutive suffix always receives primary stress, and consequently the primary stress is shifted from its normal position in the word to which the diminutive suffix has been added. In those cases where the tonic syllable of the base word contains /ɛ/ or /ɔ/, this vowel is raised one step in the diminutive form; e.g. /ɛ/ becomes [e] and /ɔ/ becomes [o] (cf. Thomas 1969: 347):

<u>copo</u>	[kópu]	'cup'
<u>côpinho</u>	[kopĩnu]	'little cup'
<u>cesta</u>	[sɛ́stɔ]	'basket'
<u>cêstinha</u>	[sestĩnɐ]	'little basket'

The alternation of the mid vowels under stress is also demonstrated in certain verbal paradigms (cf. Jucá 1961: 156):

<u>invejar</u>	[ĩvežár]	'to envy'
<u>invejo</u>	[ĩvéžu]	'I envy'
<u>corar</u>	[korár]	'to color'
<u>coro</u>	[kóru]	'I color'

Given the above data, a further rule must be stated in order to account for the stress-conditioned alternations of the mid vowels, a rule of the form:

$$(17) \quad \begin{bmatrix} V \\ -\text{high} \\ +\text{mid} \\ -\text{stress} \end{bmatrix} \rightarrow [+high]$$

Since the phenomenon described by rule (17) is merely part of the overall process of unstressed vowel raising as described by rule (16), these two rules should be compressed into a single general rule, which would account for the following stress-conditioned alternations which occur in Brazilian Portuguese:

$$\begin{array}{ll} /e/ \sim [i] & /o/ \sim [u] \\ /ɛ/ \sim [e] & /ɔ/ \sim [o] \\ & /a/ \sim [ɐ] \end{array}$$

Thus, the vowel raising rule, in its most general form, would be the following:

$$(18) \quad \begin{bmatrix} V \\ \alpha \text{ high} \\ \beta \text{ mid} \\ -\text{stress} \end{bmatrix} \rightarrow \begin{bmatrix} \beta \text{ high} \\ -\alpha \text{ mid} \end{bmatrix}$$

While rule (18) meets the criterion of descriptive completeness, it is somewhat artificial appearing as a description of a supposedly natural and unified process, since the double alpha-switching effect completely obscures the reality of a step-by-step raising process. This appearance may be due in part to the particular choice of distinctive features, but experimentation with other commonly employed sets of features yields equally artificial-looking descriptions. Such a shortcoming may point to the need for allowing non-binary features to appear in underlying

representations, at least in the case of vocalic aperture. In fact, some investigators, notably Kim (1966: 91, 1968, 1970) have shown that the use of two binary features to describe vocalic aperture results in a totally unnatural description. Consider, therefore, assigning the following values of height to the Brazilian Portuguese vowels:

4:	i		u
3:	e		o
2:	ɛ	ɐ	ɔ
1:		a	

One may now reformulate the rule of unstressed vowel raising as follows:

$$(19) \quad \left[\begin{array}{c} v \\ n \text{ high} \\ -\text{stress} \end{array} \right] \rightarrow [n+1 \text{ high}] \quad (1 \leq n \leq 3)$$

Such a formulation describes explicitly the fact that not only are unstressed vowels raised, but they are raised by exactly one step of the four degree Brazilian Portuguese vocalic system. For this reason, rule (19), while descriptively equivalent to (18), is superior, since it appears to more accurately characterize what a speaker might be expected to hear.

Although the 'simplicity metric' is not employed as a criterion of acceptability in this study, as stated in Chapter Two, it is interesting to see how such a metric would evaluate the two descriptions proposed above. Adopting the proposal of Contreras (1969) whereby variables count 1, plus and minus values (including expressions of the form n+1) count 2, and integers count the number of possible values that they may assume, one sees that the non-binary rule

(19) is significantly simpler than the binary rule (18). Thus, at least in the present instance, the simplicity metric actually favors a non-binary solution.

3.5. The semivowels

The status of the Brazilian Portuguese semivowels or glides [j] and [w] has long been a subject of controversy. In particular, some studies, such as Hall (1943a, b) and Reed and Leite (1947) have treated [j] and [w] as positional variants of the vowel phonemes /i/ and /u/, respectively. Other analyses, such as Mattoso Câmara (1953) and Head (1965) have set up separate glide phonemes /j/ and /w/. The latter sort of analysis has been based on several apparently phonemic contrasts between the glides and the corresponding high vowels, as illustrated by the following examples:

<u>riu</u>	[xiw]	'he laughed'
<u>rio</u>	[xiu]	'river'
<u>you</u>	[vów]	'I go'
<u>vôo</u>	[vóu]	'flight'
<u>sois</u>	[sójs]	'you (fam. pl.) are'
<u>soes</u>	[sóis]	'that you (fam.) soar'
<u>deu</u>	[déw]	'he gave'
<u>dê-o</u>	[déu]	'give it'
<u>quando</u>	[kwẽdu]	'when'
<u>coando</u>	[kuẽdu]	'straining'

The validity of such contrasts, however, may be called into question. Reed and Leite (1947) in their analysis of the dialect of São Paulo, indicate that the distinction illustrated above is artificial and not ordinarily made by native speakers. Rogers (1954: 505), in reviewing Mattoso Câmara (1953) with respect to the analysis of /j/ and /w/

as separate phonemes, also feels that the above distinctions, at least in Brazil, are 'highly artificial'. Head (1965: 59) states that 'some educated cariocan speakers' make these distinctions. Whatever the technical status of the two oppositions shown above, it appears that in Brazilian Portuguese, the oppositions [i]/[j] and [u]/[w] where they exist at all, are on the way out. In the present investigator's experience with spoken Brazilian Portuguese, this distinction has never been observed except in highly artificial situations in which requested words were reproduced in isolation. As a result of these observations, the present study does not consider the distinctions between [i] and [j] and between [u] and [w] to be valid for large segments of the Brazilian population, and therefore there is not seen to be a valid reason for positing separate glide phonemes /j/ and /w/.⁹

The above remarks seem to suggest that Brazilian Portuguese [j] and [w] can be derived from underlying high vowels. The best way of visualizing such a claim is by examining the occurrences of the glides, namely in the diphthongs. Brazilian Portuguese commonly exhibits the following oral diphthongs:¹⁰

[ej]	<u>feira</u>	'fair'
[ɛj]	<u>papéis</u>	'papers'
[aj]	<u>vai</u>	'he goes'
[ɔj]	<u>herói</u>	'hero'
[oj]	<u>dois</u>	'two'
[uj]	<u>fui</u>	'I was'

[iw]	<u>viu</u>	'he saw'
[ew]	<u>meu</u>	'my'
[ɛw]	<u>céu</u>	'sky'
[aw]	<u>pau</u>	'stick'
[ɔw]	<u>pó utilizado</u>	'used powder'
[ow]	<u>vou</u>	'I go'
[je]	<u>série</u>	'series'
[jɛ]	<u>dieta</u>	'diet'
[ja]	<u>fiar</u>	'to trust'
[jɔ]	<u>teórico</u>	'theoretical'
[jo]	<u>miolo</u>	'crumb'
[ju]	<u>miudo</u>	'small'
[wi]	<u>lingüística</u>	'linguistics'
[we]	<u>lingüeta</u>	'bolt'
[wɛ]	<u>cueca</u>	'shorts'
[wa]	<u>qual</u>	'which'
[wɔ]	<u>quota</u>	'quota'
[wo]	<u>o ôco</u>	'the hole'

In most of the above examples, the lower element of the diphthong always receives primary stress. In Portuguese, however, oral diphthongs often occur in unstressed position.

Assuming that [j] is a positional variant of /i/ and that [w] is a positional variant of /u/, the general interpretation of the oral diphthongs described above is that an unstressed high vowel becomes a glide when in hiatus with another (usually stressed) vowel. Such a statement entails a rule of the following nature:

$$(20) \quad \left[\begin{array}{c} \text{V} \\ +\text{high} \\ -\text{mid} \\ -\text{stress} \end{array} \right] \rightarrow [-\text{voc}] / \left[\begin{array}{c} \text{V} \\ \langle +\text{stress} \rangle \\ \langle +\text{high} \rangle \\ \langle -\text{mid} \rangle \end{array} \right]$$

Such a rule is implicit in an analysis such as Hall (1943a) and is made explicit by Saciuk (1970: 207). The entailment of +stress to the right of the environment bar is required only when both elements of the diphthong are high; e.g. in cases like [uj]/[wi] and [iw]/[ju]. A rule such as (20) signifies, in effect, that a high vowel next to another

vowel in the underlying representation is converted to a glide; i.e. forms a diphthong. Since (if examples like the ones stated previously are not considered generally valid for the carioca dialect) surface contrasts between high vowels and glides do not exist, a rule such as (20) is too powerful, since it posits underlying segments which are never phonetically realized. On the other hand, since the glides do not occupy phonemic status in the dialect under consideration, positing fully specified underlying /j/ and /w/ presents a picture which is much more complex than the real situation. It appears, in fact, that glide formation in Portuguese should be covered merely by a redundancy rule which would predict the occurrence of a glide from its environment. The features that the high vowels and the glides have in common is that they are +high, -mid, and -consonantal. In addition, [u] and [w] are +back, and [i] and [j] are +front. In other words, the only feature separating the high vowels from the corresponding glides is the feature 'vocalic,' or, equivalently, 'syllabic.' This, then, is precisely the condition which will characterize glide formation in Brazilian Portuguese, a condition which may be stated as:

$$(21) \quad \begin{bmatrix} -\text{cons} \\ +\text{high} \\ -\text{mid} \\ -\text{stress} \end{bmatrix} \rightarrow [-\text{voc}] / \begin{bmatrix} \text{V} \\ \langle +\text{high} \rangle \\ \langle -\text{mid} \rangle \\ \langle +\text{stress} \rangle \end{bmatrix}$$

a description such as the one offered by rule (21) does not attempt to determine the abstract status of [j] and [w] by means of commutation, or by showing them similar to

either vowels or consonants.¹¹ Rather, the surface forms [j] and [w] are shown to arise from a purely natural and completely predictable surface redundancy, easily available to the native speaker.

3.6. Epenthetic initial vowels

Portuguese, like Spanish, does not permit initial clusters of s plus consonant. Instead, an [i] (orthographically e) is prefixed to this cluster. Such a phenomenon is completely general and can be witnessed by listening to a native speaker of Portuguese or Spanish trying to speak a language such as English or Italian which permits initial sC clusters. The speaker of Spanish or Portuguese will (until such a time as he has mastered the foreign pronunciation) invariably prefix an [e] or [i] to all occurrences of initial sC. This phenomenon may also be observed in Portuguese through borrowed forms:

<u>esquiar</u>	[iskjár]	'to ski'
<u>smoking</u>	[izmókiŋ]	'tuxedo'

Since the occurrence of [i] before the cluster of initial s plus consonant is completely regular in Portuguese, it can be described by a redundancy rule such as:

$$(22) \quad \emptyset \rightarrow \left[\begin{array}{c} V \\ +\text{high} \\ -\text{mid} \\ +\text{front} \end{array} \right] / \text{---} \left[\begin{array}{c} +\text{ant} \\ +\text{cor} \\ +\text{cont} \end{array} \right] C$$

The first bundle of distinctive features to the right of the environment bar in (22) is not specified as to voice, since the voicing is predictable by a process of voicing assimilation, as will be shown elsewhere in this study.

3.7. Epenthetic final vowels

Brazilian Portuguese often gives the impression of being a language all of whose words end with vowels. This impression is not entirely correct, but it is true that no native Portuguese word ends in a stop. Instead, either a continuant or a vowel is found. In the case of such items as verb forms, adjectives, etc., the choice of the final vowel is not arbitrary, but rather plays a grammatical role in determining gender, number, person, etc. On the other hand, in a large class of words, including words borrowed from other languages which originally ended with a stop, an [i] (orthographically e) is suffixed. This process may be seen by considering recent borrowings from English:

<u>clube</u>	'club'
<u>pingue-pongue</u>	'ping-pong'
<u>bifteque</u>	'steak'
<u>time</u>	'team'
<u>dringue</u>	'drink'
<u>coniaque</u>	'cognac'

The general condition, then, is that whenever a specific vowel is not required for general morphological processes, an [i] is suffixed to words which would otherwise end in a stop. Such a phenomenon can be characterized by a rule such as the following:

$$(23) \quad \emptyset \rightarrow \left[\begin{array}{c} \text{v} \\ +\text{high} \\ -\text{mid} \\ +\text{front} \end{array} \right] / [-\text{cont}] _____\#$$

It has been seen in the preceding paragraphs that recent borrowings were used as examples of a phonological process still in operation. The use of borrowings to determine currently productive rules is a useful tool, treated at

some length by Hyman (1970a, b). Augmenting the description of a language with information about borrowed forms has been recently characterized by Hyman (1970b):

Thus it is not the case that a handful of borrowed words suffice in themselves ... but rather these borrowed cases should be seen as an institutionalized reflex of a more general on-going process, that of perceiving and reproducing foreign words and sequences. (p. 27)

3.8. Variation in verbal stems

The preceding sections have described the oral vocalic phenomena generally exhibited by Brazilian Portuguese. In addition to these general phenomena, the carioca dialect exhibits a large amount of vocalic variation within the stems of certain verbs. Such phenomena are usually regular within the particular paradigm being considered.

The major purpose of the present study is to determine the extent to which an unordered set of output conditions can describe the form of a Brazilian Portuguese word, and for this reason, verb stem vocalic variations, which are basically morphological in nature, are only of peripheral interest. However, for the sake of completeness, a typical example of such a variation will be examined to show how the general system of verbal paradigmatic vowel alternations can fit into the posited scheme of output constraints. A complete treatment of the various vocalic variations exhibited by the Portuguese verbal system can be found in Eastlack (1965).

The examples chosen for illustration in this section constitute the class of so-called 'stem-changing' verbs of

the second conjugation in -er and of the third conjugation in -ir. These are the verbs which have a stressed /e/ or /o/ as a stem vowel in the present indicative tense. An example of vocalic variation in verbs of the second conjugation is as follows:

<u>escrever</u>	'to write'
<u>escrevo</u>	[iskrévu]
<u>escreve</u>	[iskrévi]
<u>escrevemos</u>	[iskrivémus]
<u>escrevem</u>	[iskrévēʃ]
<u>escolher</u>	'to choose'
<u>escolho</u>	[iskólu]
<u>escolhe</u>	[iskóli]
<u>escolhemos</u>	[iskuλέmus]
<u>escolhem</u>	[iskólēʃ]

Examples of stem-changing verbs of the third conjugation are as follows:

<u>servir</u>	'to serve'
<u>sirvo</u>	[sírvu]
<u>serve</u>	[sírvi]
<u>servimos</u>	[sirvímus]
<u>servem</u>	[sérvēʃ]
<u>tossir</u>	'to cough'
<u>tusso</u>	[túsu]
<u>tosse</u>	[tósi]
<u>tossimus</u>	[tusímus]
<u>tossem</u>	[tósêʃ]

The general pattern exhibited by such verbs is that a more closed vowel is found in the first person singular form, and a more open vowel is found in the third person forms. Since the stem vowel is unstressed in the first person plural forms, it follows the general pattern of unstressed vowel raising. In the stem-changing verbs of the second conjugation, the variation is of only one degree

of vocalic height; i.e. [o]/[ɔ] and [e]/[ɛ]. In the third conjugation stem-changing verbs, the variation is over two degrees of vocalic aperture; i.e. [u]/[ɔ] and [i]/[ɛ]. The two processes are basically variations of the same phenomenon, and they are completely regular within the class of Portuguese verbs. They should therefore fall within the domain of a single phonological rule, which would be of a form similar to:

$$(24) \quad \left[\begin{array}{c} v \\ +mid \\ +stress \\ \{+2nd \text{ conj.}\} \\ \{+3rd \text{ conj.}\} \end{array} \right] \rightarrow \left\{ \begin{array}{l} \left[\begin{array}{c} [+high] \\ [-mid] \end{array} \right] / \left[\begin{array}{c} \text{---} \\ +I \\ \langle +3rd \text{ conj.} \rangle \end{array} \right] \\ \left[\begin{array}{c} [-high] \\ \{+II\} \\ \{+IV\} \end{array} \right] \end{array} \right\}$$

The Roman numerals refer to the person numbers. In spoken cariocan Portuguese, only four verb forms are generally used, the second person forms in tú and vós are no longer current, although they appear frequently in the literature and in highly emotional situations.

The formidable appearing rule (24) represents an attempt at formalizing one of the many vocalic variations present in the Portuguese verbal paradigms. While it is morphonological in form, it is straightforward in nature and maps directly from the underlying representation to the surface phonetic forms. The other vocalic variations of the Portuguese verb system are similarly general within a specific class, and therefore no further mention will be made of them in the present study.

FOOTNOTES

1. See, for example, Head (1965: 97).
2. For example, Mattoso Câmara (1953), Reed and Leite (1947).
3. See Head (1965), Morais-Barbosa (1961), Malmberg (1962), Lacerda (1958), Lacerda and Hammarström (1952).
4. This is in fact noted by Lüdtkke (1953: 197):

estes últimos apresentam um problema por serem ξ ɔ menos abertos do que a; o, e menos abertos do que p, de maneira que dum ponto de visto puramente fonético, não funcional, ξ, ɔ correspondem a p, sendo a mais aberto; o, e mais fechados, em comparação com aqueles; resultaria de tais considerações um esquema de quatro graus de abertura, como em italiano e em catalão.
5. Herculano de Carvalho (1962) places this change around the 16th century or before, while Naro (1971c) and others consider it to have occurred somewhat later.
6. As in Naro (1971c), who in turn has taken his ideas from those of Zipf.
7. Using the mirror-image convention for rule environments as found in Bach (1967).
8. For example Naro (1971c: 640). Coates and de Silva (1960) show the effects of Portuguese on the evolution of Sinhalese.
9. An alternate descriptive analysis may be found in Madonia (1966), who ascribes phonemic status to certain falling diphthongs.
10. A more liberal interpretation of Portuguese diphthongs is found in Lindstrand (1943), who claims a total of 86 oral and nasal diphthongs for Portuguese.
11. Head (1965) classifies the glides together with /r/ in the category of consonants.

CHAPTER FOUR

THE NASAL VOWELS

4.1. Introduction

In addition to the oral vowels discussed in the preceding chapter, Brazilian Portuguese has the following nasal vocalic segments: [ĩ], [ẽ], [ẽ̃], [õ], and [ũ]. Phonetically, they are the nasalized counterpart of the oral vocalic segments [i], [e], [ɐ], [o], and [u], respectively. Using the distinctive features chosen for the description of the Portuguese vowels results in the following specification for the nasal vowels:

	<u>i</u>	<u>e</u>	<u>ɐ</u>	<u>o</u>	<u>u</u>
high	+	+	-	+	+
mid	-	+	+	+	-
front	+	+	-	-	-
back	-	-	-	+	+
nasal	+	+	+	+	+

Brazilian Portuguese nasal vowels enter into phonemic opposition with the corresponding oral vowels, as illustrated below:

<u>vim</u>	(vĩ)	'I came'
<u>vi</u>	[vi]	'I saw'
<u>prenso</u>	[prẽsu]	'I compress'
<u>preço</u>	[prẽsu]	'price'
<u>lã</u>	[lẽ]	'wool'
<u>la</u>	[lɐ]	'she (enclitic)'
<u>som</u>	[sõ]	'sound'
<u>só</u>	[so]	'only'
<u>o</u>	[u]	'the {m. sg.}'
<u>um</u>	[ũ]	'one {m. sg.}'

4.2. Methods of analysis

Traditionally, there have been two basic methods of

fitting the nasal vowels into the scheme of Portuguese phonology. Head (1965), utilizing the phonemic contrasts between oral and nasal vowels, as illustrated above, in addition to statements about the syllabic structure of Brazilian Portuguese, has seen the need to posit a complete series of nasal vowel phonemes: /ĩ/, /ẽ/, /ã/, /õ/, and /ũ/. A similar claim is offered for Iberian Portuguese, based on different arguments. Head's arguments for the phonemic status of nasal vowels in the carioca dialect may be found on pp. 65-78, while the claims for Iberian Portuguese are listed on pp. 94-5.

A strong argument in favor of the claims for Iberian Portuguese results from the phonetic realization of triplets such as:

<u>vi</u>	[vi]	'I saw'
<u>vim</u>	[vĩ]	'I came'
<u>vime</u>	[vimə]	'wicker'

In standard Iberian Portuguese pronunciation there is a tendency to eliminate final unstressed vowels, with the result that vime tends to be pronounced [vim], thus yielding a three-way contrast between oral vowel, oral vowel plus nasal consonant in the same syllable, and nasal vowel. Such a situation is analagous to the French triplet beau, bon, bonne.¹ A similar situation, however, does not fully obtain in the modern carioca dialect. While there is a tendency to drop final unstressed vowels, there seems to be at the same time a strong awareness of their presence, even when they have all but disappeared from normal pronunciation. For example, if the final unstressed vowels were lost in

the minds of the speakers at the same time that they became lost phonetically, one would expect the language to develop a tolerance for words ending in a stop. That this is not the case for Brazilian Portuguese is easily demonstrated by examining recent borrowings, where a final e is suffixed to all borrowed forms ending in a stop, as discussed in the preceding chapter. At this point, then, no further mention will be made of the attempts of Head and others to establish separate nasal vowel phonemes on such criteria.

The alternate phonemic solution to the problem of the Brazilian Portuguese nasal vowels is to consider each instance of a nasal vowel to consist of an oral vowel followed by either a nasal consonant or by some manner of 'archiphoneme of nasality' (alternatively, by a phoneme of nasality). The majority of phonemic studies of Brazilian Portuguese nasal vowels have adopted this second alternative in some form. The fundamental basis for such an assumption is that every instance of a (phonetic) nasal vowel in Portuguese is either followed orthographically by a nasal consonant or is marked with the til~, which indicates nasalization. In particular, Morais-Barbosa (1961, 1965) has considered each nasalized vowel to be followed in the same syllable by an archiphoneme of nasality /N/. In the instances where a nasal consonant appears, at least orthographically, Morais-Barbosa's statement is tantamount to stating that vowels are nasalized by a following tautosyllabic nasal consonant. This can be substantiated by the lack, in

Brazilian Portuguese, of contrast between nasal vowels and vowels followed in the same syllable by a nasal consonant. On the other hand, in cases where nasalization is merely indicated by a til, or not orthographically indicated at all, Morais-Barbosa's archiphoneme of nasality becomes in fact an abstract underlying form, as illustrated below:

<u>fim</u>	[fĩ]	/fiN/	'end'
<u>quanto</u>	[kwẽtu]	/kwaNto/	'how much'
<u>lã</u>	[lẽ]	/laN/	'wool'
<u>irmã</u>	[irmẽ]	/irmaN/	'sister'
<u>tempo</u>	[tẽpu]	/teNpo/	'time'

In cases such as the above, the archiphoneme /N/ is taken to be the conditioning factor which nasalizes the preceding vowel.

Other studies of Brazilian Portuguese, notably Hall (1943a), have posited a separate phoneme of nasality, usually indicated /~/. Such a phoneme would be superimposed on an oral vowel phoneme in the same fashion that supersegmental phonemes, such as stress or pitch, are superimposed on various vocalic segments.

The analysis of Reed and Leite (1947) treats the nasal vowels as phonemically oral vowels followed in the same syllable by a nasal consonant. A nasal vowel in phrase- (word) final position is analyzed as being followed by a phonetic [ɲ] or [ŋ], both arising from phonemic /ɲ/.

The studies mentioned above, and others like them, have all sought to determine whether the Brazilian Portuguese nasal vowels are monophonemic or consist of an oral vowel plus some sort of nasal phoneme. Although some of the investigators mentioned above, notably Head and Morais-Barbosa,

utilized phonetic data in their arguments, the end result was the placing of the nasal vowels into one of two abstract categories: the category of single phonemes or the category of positional variants.

Such a classification procedure as attempted for the Brazilian Portuguese nasal vowels and described above is for the most part quite arbitrary. The various examples cited above point eloquently to the fact that one can, depending on the particular data considered, and also on the data ignored, present a suitable case for either possible conception of nasal vowels in Portuguese. Furthermore, one can, by selectively considering the various data, arrive at one conclusion in the case of Brazilian Portuguese and at the totally opposite conclusion in the case of Iberian Portuguese. For this reason, the above studies, inasmuch as they apply to abstract phonemic patterning, are of no value to the present investigation. This study is concerned with the observable relations between the posited underlying form of a Brazilian Portuguese word and its surface manifestations. More specifically, it is concerned with determining the extent to which a Brazilian Portuguese surface form is predictable from the general structure of the language and from demonstrably productive rules. Consequently, arguments and presentations based on commutations and paradigmatic exigencies cannot be utilized to investigate the phenomenon of vowel nasalization. Instead, a detailed study must be undertaken of all the ramifications of the vowel nasalization process and the results compared to

other observations of the carioca dialect in order to reach a more complete understanding of this and other phonological processes.

Before embarking on a detailed study of vowel nasalization in Brazilian Portuguese, it is necessary to delimit some of the intrinsic difficulties involved. The first difficulty lies in the differences manifested by the various Portuguese dialects with respect to vowel nasalization. One such difference has already been noted. More detailed studies of these dialectal differences may be found in Lacerda and Head (1962), Lacerda and Hammarström (1952) and Lacerda and Rossi (1958).

A more fundamental difficulty, and one pertaining directly to the present study, is the variation of vowel nasalization observable within the same dialect. Basic to this difference seems to be the level of literacy of the individual speaker. It is very possible that a speaker of Portuguese is more likely to analyze a phonetic nasal vowel as consisting of an oral vowel plus a nasal segment if he is aware of the spelling of the word involved. Morais-Barbosa (1961: 703) speaks of an experiment in miniature realized in Lisbon. Speakers aware of the spelling of a word such as campo (phonetically [kẽ̃pu]) 'heard' five sounds, while illiterate speakers often distinguished only four. The interpretation of such an experiment must be tempered by the existence of so-called 'transition sounds' often observed when a nasal vowel is followed by a stop, as will be described later. However, it does point to the sort of

difficulties to be encountered in dealing with vowel nasalization in a heterogeneous speech community.²

On the other hand, there are phenomena exhibited in so-called 'substandard' Brazilian speech which indicate that supposedly illiterate speakers may analyze phonetically nasal vowels as the sequence of oral vowel plus nasal consonant. This is hinted by the reduction of present participle forms, which end in orthographic Vndo (phonetically [Ṽdu]) to an ending in Vno. One may also observe a reduction of the cluster mb to a simple m (cf. Thomas 1969: 220, Vasquez Cuesta 1961: 89):

<u>falando</u>	[fɛlẽ̃du]	>	[fɛlãnu]	'speaking'
<u>abrindo</u>	[ɐbrĩ̃du]	>	[ɐbrĩnu]	'opening'
<u>tambem</u>	[tɐ̃bẽ̃j]	>	[tamẽ̃j]	'again, also'

Much research is needed to determine the influence of literacy on this and other phenomena, and until such research has been accomplished, no completely general statements about vowel nasalization in Portuguese are possible. The present study has of necessity employed data furnished by educated, literate speakers of Brazilian Portuguese. For this reason, the following analyses must be considered only with respect to cultured speakers. It is quite possible that a radically different analysis would emerge from a study realized through untutored or illiterate speakers.

4.3. The basic nasalization process

The first stage of the investigation of vowel nasalization in the carioca dialect is an analysis of the most commonly observed phenomenon, the nasalization of a vowel

before an orthographically indicated nasal consonant in the same syllable. Examples of this process are:

<u>indo</u>	[ídu]	'going
<u>tempo</u>	[têpu]	'time'
<u>cambio</u>	[kêbju]	'change'
<u>alfombra</u>	[awfôbrɐ]	'carpet'
<u>mundo</u>	[mũdu]	'world'

Historically, the nasal vowels in words such as the above derived from sequences of oral vowel plus nasal consonant, as illustrated by their Spanish equivalents:

<u>yendo</u>	[jéndo]
<u>tiempo</u>	[tjémpo]
<u>cambio</u>	[kámbjo]
<u>alfombra</u>	[alfómbra]
<u>mundo</u>	[múndo]

The historical evolution then nasalized the vowel preceding the nasal consonant, and the nasal consonant was dropped phonetically.³ In fact, historically, any word internal nasal consonant usually dropped, nasalizing the preceding (and subsequently, by assimilation, the following) vowel. Such a historical process represents a rule of the form:

$$(1) \quad V \quad \left[\begin{array}{c} C \\ +nas \end{array} \right] \rightarrow \left[\begin{array}{c} V \\ +nas \end{array} \right] \emptyset$$

It remains to be seen whether any vestiges of such a historical process remain productive in contemporary Brazilian Portuguese. It seems to be the general opinion of native Brazilian scholars that a synchronic extension of rule (1) is still in effect. Statements to this effect can be found in formal linguistic descriptions such as Mattoso Câmara (1953) and Reed and Leite (1947) and in grammatical treatises such as Agard, Lobo and Willis (1944) and Abréu and Ráneh (1966). Such statements, while reflecting the

opinion of native (usually linguistically trained) speakers of Brazilian Portuguese, do not provide conclusive proof of the synchronic existence of a vowel nasalization rule. They do, however, point out the fact that awareness of such a rule exists among speakers of the language.

Bearing these facts in mind, the present study tentatively proposes the following rule for vowel nasalization, which will subsequently be examined in detail, to determine its validity:

$$(2) \quad V \longrightarrow [+nas] / \text{---} \begin{bmatrix} C \\ +nas \end{bmatrix} C_1$$

A second portion must be added to this rule which will delete the nasal consonant after the preceding vowel has been nasalized:

$$(3) \quad \begin{bmatrix} C \\ +nas \end{bmatrix} \rightarrow \emptyset / \begin{bmatrix} V \\ +nas \end{bmatrix} \text{---} C_1$$

As presently stated, rules (2) and (3) must be applied in the order (2), (3). However, as mentioned in Chapter Two, such a description is invalid, since forms resulting from the output of rule (2); i.e. forms with the sequence: nasal vowel plus nasal consonant plus consonant are never found in Portuguese. Therefore, rules (2) and (3) are but two parts of a unified process of vowel nasalization and should be described by a single statement such as:

$$(4) \quad V \begin{bmatrix} C \\ +nas \end{bmatrix} C_1 \rightarrow \begin{bmatrix} V \\ +nas \end{bmatrix} \emptyset, \quad 3$$

Rule (4) is indeed a combination of rules (2) and (3), but it is as yet without empirical validity. A possible means of justifying such a statement lies in an examination

of the occurrence of nasal vowels in Portuguese. Fully nasalized vowels; i.e. those capable of entering into a phonemic opposition with the corresponding oral vowels, occur phonetically in Brazilian Portuguese either before a phonetic consonant or word-finally. Such a situation points to an underlying nasal consonant in the grammars of many speakers, at least in the case where a nasal vowel appears phonetically before a consonant. If the nasal vowels possessed a separate phonemic existence, it would be necessary to formulate a rule to the effect that nasal vowels may only occur word-finally or before a non-nasal consonant. Such a rule, while of course theoretically possible, seems quite bizarre and is not in keeping with the general pattern of vowel nasalization. When a process of vowel nasalization is introduced into a language, it generally begins by nasalizing vowels followed in the same syllable by a nasal consonant.⁴ While subsequent modifications may render the resulting nasalized vowels merely residues of a finished process, the phonetic occurrences and distribution of nasal vowels in Brazilian Portuguese point to a process of nasalization still in operation.

With the data examined thus far, Brazilian Portuguese appears to exhibit in many instances a productive extension of the historical rule nasalizing vowels followed by tautosyllabic nasal consonants. It would seem, therefore, that vowels ending phonetically in a nasal vowel may also be visualized as somehow ending in a sequence of oral vowel plus nasal consonant, in keeping with the nasalization

condition proposed above. One can in fact observe vacillations in rapid speech which point to the productivity of such a nasalization rule in word-final position:

<u>quem</u> <u>é?</u>	[kẽjẽ]/[kẽné]	'who is it?'
<u>lã</u> <u>azul</u>	[lẽzũw]/[lẽnzũw]	'blue wool'
<u>homem</u> <u>alto</u>	[omẽjãwtu]/[omẽnãwtu]	'tall man'

Such observations suggest that words ending in a phonetic nasal vowel may be analyzed as ending in the sequence of oral vowel plus nasal segment. In those instances where the vacillation points to such an analysis, a modification of the proposed condition (4) is called for to cover the cases of word-final nasal vowels:

$$(5) \quad V \left[\begin{array}{c} C \\ +nas \end{array} \right] \left\{ \begin{array}{c} C_1 \\ \# \end{array} \right\} \rightarrow \left[\begin{array}{c} V \\ +nas \end{array} \right] \quad \emptyset, \quad 3$$

4.4. Vocalic restrictions

Rule (5) seems to adequately describe the basic process of vowel nasalization as exhibited by many speakers of Brazilian Portuguese. It constitutes only a small portion of a description of the entire process, however, since vowel nasalization in the cariocan dialect is a multifaceted phenomenon of which rule (5) is the merest skeleton.

The next point to be considered is the restriction of vowel nasalization to the vowel phonemes /i/, /e/, /a/, /o/, and /u/. Such a restriction is generally not explicitly discussed, it being considered sufficient to remark that the nasalized allophone of /a/ is the raised variant[ẽ]. nonetheless, it seems significant that only the higher vocalic segments are found in nasalized form (a fact which seem to contradict claims to the effect that nasal vowels tend to

lower⁵). Such a restriction implies the need for a rule which bars [ɛ], [ɔ], and [a] from occurring in nasalized form. Such a rule could be considered part of the general nasalization rule (5), serving not to raise underlying /ɛ/ and /ɔ/ to [e] and [o], respectively, but acting rather as an environmental constraint as to the type of vowels permitted in positions of nasalization. Such a rule would take the form:

$$(6) \quad \left[\begin{array}{c} \text{V} \\ -\text{high} \\ \alpha \text{ mid} \end{array} \right] \rightarrow \left[\begin{array}{c} \alpha \text{ high} \\ -\text{mid} \end{array} \right] / \left[\begin{array}{c} \text{---} \\ \text{P.N.} \end{array} \right]$$

P.N. (position of nasalization) has been included in the environment of (6) to show that this condition is not ordered with respect to the general nasalization rule (5) but rather that it is an integral part of the nasalization process which specifies the permissible vowels in the nasalization position. Since current phonological descriptive devices have been formulated for use with sequentially ordered rules, there existed no neat way of portraying the interlocking of (5) and (6), and an ad hoc specification had to be made.

Rule (6), while giving the correct phonetic output, serves in reality to raise underlying lower vowels. An alternative description, and one that would take into account the fact that the peripheral vowels are apparently affected differently from the central vowels in the constraints of nasalization would take the following form:

$$(7) \quad \left[\begin{array}{c} \text{v} \\ \alpha \text{ front} \\ \beta \text{ back} \\ -\text{high} \end{array} \right] \rightarrow \left\{ \begin{array}{l} [+high] \\ \alpha = -\beta \\ [+mid] \\ \alpha = \beta \end{array} \right. / \left[\begin{array}{c} \text{---} \\ \text{P.N.} \end{array} \right] \}$$

This description, however, is not ideal since it obscures the fact that the process involved is merely a phenomenon of raising.

A further generalization is perhaps possible at this point. It was stated above that a condition such as (6) or (7) is merely a statement to the effect that only higher vowels occur in nasalized form in the carioca dialect. The vowels /i/, /e/, /o/, and /u/ are all specified as +high. The segment[ɐ] has up to this point been specified as -high, +mid. In nasalized form, however, the vowel[ẽ] has an observable tendency to raise to a height between that of /e/ and that of /i/, there being no other central vowels for it to interfere with.⁶ Such an observation lends support to the claim that only higher vowels may be nasalized in Brazilian Portuguese, and leads to a more general and accurate constraint on nasalizable vowels:

$$(8) \quad \text{v} \rightarrow [+high] / \left[\begin{array}{c} \text{---} \\ \text{P.N.} \end{array} \right]$$

It must be emphasized at this point that the somewhat ad hoc appearance of (8) is due to the necessity for viewing it not as a step in an ordered chain of rules but rather as an inherent facet of the multidimensional vowel nasalization process which has been sketched in its most rudimentary form in (5).

4.5. Word-final diphthongization

The next topic to be considered is the fact that normally the nasal vowels [ẽ] and [ẽ̃] do not appear singly in word-final position, but rather as the nasal diphthongs [ẽj̃] and [ẽw̃], respectively:

<u>tem</u>	[tẽj̃]	'he has'
<u>homem</u>	[ómẽj̃]	'man'
<u>falam</u>	[fálẽw̃]	'they speak'
<u>são</u>	[sẽw̃]	'they are'

St. Clair (1971: 99-100) has considered these examples to be manifestations of a more general rule which produces a glide at the end of all word-final nasal vowels, with subsequently ordered rules bleeding off the undesired *[õw̃], *[ũw̃], *[ĩj̃], etc. Saciuk (1970: 207) has considered a simple rule which attaches the appropriate glide to word-final [ẽ] and [ẽ̃] :

$$(9) \quad \emptyset \rightarrow \left[\begin{array}{l} -\text{voc} \\ -\text{cons} \\ \alpha \text{ back} \end{array} \right] / \left[\begin{array}{l} \text{V} \\ +\text{nas} \\ \alpha \text{ back} \\ -\text{high} \end{array} \right] \text{---} \text{C}_0\#$$

However, the rule as formulated by Saciuk must be ordered after the nasalization rule proper, and before a secondary nasalization rule which nasalizes glides and vowels contiguous to nasalized vowels, and hence nasalizes [ẽj̃] and [ẽw̃] to [ẽj̃̃] and [ẽw̃̃], respectively.

The present investigation, however, is operating under the assumption that vowel nasalization in Brazilian Portuguese is a single, unified process which consists of several interrelated phenomena. For this reason, a means of producing the word-final nasalized glide increments must be considered which is an integral part of the vowel nasalization process,

not ordered before or after any other part, and which produces a fully specified nasalized glide segment in a single operation. Such a process may be described by an additional condition to the general nasalization rule (5) and would be of the form:

$$(10) \quad \emptyset \rightarrow \left[\begin{array}{l} -\text{voc} \\ -\text{cons} \\ +\text{nas} \\ \alpha \text{ front} \end{array} \right] / \left[\begin{array}{l} V \\ +\text{mid} \\ -\text{back} \\ \alpha \text{ front} \\ \text{P.N.} \end{array} \right] \text{---} C_o\#$$

Such a condition is not yet a complete description of glide formation after word-final nasal vowels, since a certain alternation is exhibited in this position. While a condition such as (10) applies to all instances of word final [ẽ], in the case of word final [ẽ̃] alternation is exhibited in stressed position between [ẽ̃] and [ẽ̃w̃]. Such an alternation is indicated by the orthography, and is illustrated by the following examples:

<u>tão</u>	[tẽw̃]	'so much'
<u>irmão</u>	[irmẽw̃]	'brother'
<u>lã</u>	[lẽ̃]	'wool'
<u>irmã</u>	[irmẽ̃]	'sister'

In the case of words ending in stressed [ẽ̃] (orthographically ã), which may be analyzed as ending in the sequence /a/ plus nasal segment, the condition stated in (10) clearly does not apply. Consequently, (10) must be modified with an additional constraint which limits its action to all occurrences of word-final [ẽ̃] and only to unstressed occurrences of word-final [ẽ̃̃], since in the latter case contrast is possible between the single nasal vowel and the nasal diphthong. The final glide-formation rule must therefore take the form:

$$(11) \quad \emptyset \rightarrow \left[\begin{array}{l} -\text{voc} \\ -\text{cons} \\ +\text{nas} \\ \alpha \text{front} \end{array} \right] / \left[\begin{array}{l} \text{V} \\ +\text{mid} \\ -\text{back} \\ \alpha \text{front} \\ \langle -\text{front} \rangle \\ \langle -\text{stress} \rangle \\ \text{P.N.} \end{array} \right] \text{---} \text{C}_0 \#$$

Once again it must be born in mind that (11) is not in itself a separate rule of cariocan phonology which can operate independently of other generally operative rules. It is rather an additional constraint on the general and far-reaching process of vowel nasalization which it is the aim of this chapter to describe.

4.6. Unstressed diphthongs

One notices at this point that the occurrences of unstressed [ě̃j] in such words as ontem [ótě̃j] and homem [ómě̃j] constitute a clear exception to the description of unstressed vowel raising as presented in rule (19) of the preceding chapter. Although one could consider occurrences of unstressed [ě̃j] as exceptions to the general condition of unstressed vowel raising, the regular occurrence of such forms points instead to a slight revision of the vowel-raising condition which would take this phenomenon into account. It is noticed at this point that the determining factor for unstressed mid vowels to occur may be either the presence of nasalization or the presence of a diphthong. The latter alternative seems more plausible, when one also considers the previously mentioned irregular plurals of nouns and adjectives ending in unstressed -il which form their plurals in unstressed [ejs]. Further support for this claim may be found in such words as faltar [fawtar] where

unraised [a] is found in the unstressed diphthong. These observations suggest a tentative restriction on the previously stated condition for unstressed vowel raising to permit (although not necessarily to require) unstressed vowels to occur in their non-raised form as the first member of a diphthong:

$$(12) \quad \left[\begin{array}{c} \text{V} \\ \text{n high} \end{array} \right] \rightarrow [\text{n+1 high}] / \left[\begin{array}{c} \text{---} \\ \text{-stress} \end{array} \right] \left(\begin{array}{c} \text{V} \\ \left\{ \begin{array}{c} +\text{high} \\ -\text{mid} \\ +\text{stress} \end{array} \right\} \\ [+cons] \\ \# \end{array} \right)$$

4.7. Nasal diphthongs

Perhaps the most difficult of Portuguese vowel nasalization, at least judging from the diverse interpretations to be found in the literature, is the subject of the nasal diphthongs. Aside from the final glides attached to [ẽ] and [ẽ̃] as described above, which is a totally redundant and predictable phenomenon covered by (11), Brazilian Portuguese exhibits the following nasal diphthongs:

[ẽj]	<u>mãe</u>	[mẽj]	'mother'
[ẽw]	<u>mão</u>	[mẽw]	'hand'
[õj]	<u>põe</u>	[põj]	'he puts'
[ũj]	<u>muíto</u>	[mũjtu]	'much'

Historically, the principal source for the Portuguese nasal diphthongs was the loss of intervocalic -n- (cf. Williams 1962: 70-71) as shown by the following table:

<u>Latin</u>	<u>Spanish</u>	<u>Portuguese</u>	<u>gloss</u>
<u>manu(s)</u>	<u>mano</u>	<u>mão</u>	'hand'
<u>panes</u>	<u>panes</u>	<u>pães</u>	'loaves'
<u>pone</u>	<u>pone</u>	<u>põe</u>	'he puts'

Following the tradition established by well-known works of generative phonology, all the generative phonological

treatments of Brazilian Portuguese have derived the present-day Portuguese forms containing nasal diphthongs from underlying forms closely resembling their historical antecedents, via a long series of ordered rules approximating the historical developments. For example, Saciuk (1970: 207) derives pão from underlying /pane/ (cf. Latin pane) via the following series of successive stages:

	/pane/
nasalization	pã̃ne
n-deletion	pã̃e
apocope	pã̃
glide-insertion	pẽ̃w
secondary nasalization	pẽ̃w̃

St. Clair (1971: 99) derives Portuguese nação from underlying /natione/ (the Latin etymon) as follows:

	/natione/
assibilation	nasone
nasalization	nasõ̃ne
nasal loss	nasõ̃e
apocope	nasõ̃
glide increment	nasõ̃w
vowel lowering adjustment	nasã̃w

Such a derivation, despite its many steps, still does not produce the correct surface form, which is [nɐsẽw̃], with raised initial vowel and nasalized final glide segment. While the generative phonological treatments of Brazilian Portuguese have taken for granted the fact that nasal diphthongs are derived from underlying forms resembling their Latin etyma, as illustrated above, surprisingly little concrete evidence has been put forward to justify such a claim. Saciuk (1970: 198-9) justifies his treatment of the diphthong ão, as illustrated above, by the following

set of words supposedly intimately related to pão:

<u>panificação</u>	'bakery'
<u>panificador</u>	'baker'
<u>panificar</u>	'to make bread'
<u>panar</u>	'to bread'

Such examples then constitute Saciuk's evidence for the claim that pão contains the underlying formative /pan/. Supposedly the forms listed above would be specified as -native in the lexicon and hence would not undergo the long process needed to derive such +native forms as pão. Thus one has commonly used 'native' words requiring a great deal more phonological derivation than their corresponding 'non-native' derivatives. Saciuk's claim is then extended to the entire class of Portuguese words ending in -ão. What such a demonstration fails to consider, among other things, is the highly learned and restricted nature of the Latinized variants which can be found for (only a very small number of) words in -ão. In the instance cited above, for example, while pão, the word for 'bread,' is probably in the vocabulary of every Portuguese-speaking individual, the commonly used words for 'bakery' and 'baker' are padaria and padeiro, respectively. Furthermore, the verbs panar and panificar are specialized culinary terms used only by those skilled in the art of cooking and bread-making and do not constitute part of the common vocabulary of all, or even most, Brazilian speakers. The average Brazilian speaker would probably render 'to make bread,' for example, by a paraphrase such as fazer pão. The use of borrowed or learned forms to justify the positing of abstract base forms for common words which

have undergone the regular processes of historical evolution seems, in the case of the Portuguese nasal diphthongs, to be totally unjustified. A further reason to doubt such claims lies in the large number of Portuguese words containing nasal diphthongs for which no learned derivatives can be found, and also the words whose nasal diphthongs did not arise from the regular historical process of loss of intervocalic -n-. Examples of the latter category include:

<u>Latin</u>	<u>Spanish</u>	<u>Portuguese</u>	<u>gloss</u>
<u>mater</u>	<u>madre</u>	<u>mãe</u> [mẽj]	'mother'
<u>pater</u>	<u>padre</u>	<u>pai</u> [pẽj]	'father'
<u>multu</u>	<u>mucho</u>	<u>muito</u> [mũjtu]	'much'

A much more consistent solution to the problem of Portuguese nasal diphthongs is the one offered by Morais-Barbosa (1965). It will be recalled from an earlier discussion that Morais-Barbosa analyzed the Portuguese nasal vowels as an oral vowel followed in the same syllable by an archiphoneme of nasality /N/. Extending this concept logically to the case of nasal diphthongs, gives the following results:

<u>pão</u>	/pawN/	'bread'
<u>mãe</u>	/majN/	'mother'
<u>muito</u>	/mujNto/	'much'

Since the evidence thus far considered indicates that the historical processes which led to the formation of nasal diphthongs in Portuguese are no longer productive, and can be traced only through learned forms, a solution similar to that proposed by Morais-Barbosa suggests itself for the present description of the Portuguese nasal diphthongs.

The preceding sections have shown that the description of Portuguese nasal vowels most consistent with the observed data can be attained by analyzing nasal vowels as being followed in the same syllable by a nasal segment. The previous paragraph has indicated that there exists no valid synchronic reason for considering modern Portuguese nasal diphthongs to arise from two underlying vowels separated by a nasal consonant. Instead they behave in a manner identical to that exhibited by the single nasal vowels; i.e. as oral vowels followed and nasalized by a tautosyllabic nasal consonant. This observation suggests that the formation of the Portuguese nasal diphthongs be considered as an extension of the vowel nasalization process described earlier.

If such a description is to be adopted, the first point which must be clarified is the manner in which both elements of the diphthong are nasalized. Under the traditional restrictions of a system of individual rules, an iterative rule would be needed which would nasalize each vowel separately, starting with the vowel closest to the nasal consonant. The present investigation has indicated, however, that vowel nasalization in Portuguese is an inherently unified process, not one that operates by successive stages. As a consequence of such a position, the nasalization of the two elements constituting a nasal diphthong must be considered as a single phenomenon, not as an iterative, two-step process. Such a claim is in some measure supported by the fact that occurrences of a diphthong, one of whose elements is oral and the other nasal, are completely unknown

in Portuguese. The present study therefore considers that the most likely method of forming a nasal diphthong is that of a single process of nasalization which simultaneously nasalizes both the elements of which the diphthong is comprised.

A second point which must be discussed if nasal diphthongs are to be considered as manifestations of the general phenomenon of vowel nasalization is the form in which these diphthongs are to be represented in their underlying or stored forms. Under the interpretation proposed by Morais-Barbosa, the second member of the nasal diphthong is to be considered as an underlying completely-specified glide. On the other hand, the generative treatments of Portuguese have considered nasal diphthongs to arise from two completely specified underlying vowels, one of which is subsequently reduced to a glide by the application of later rules. Neither of these interpretations is consistent with the observed data. First of all, it has been pointed out that in the carioca dialect there are no phonemic glides, but rather the occurring glides may be redundantly determined from their environments. Second, the positing of two completely specified vowels as underlying a nasal diphthong sets it off as somehow different from oral diphthongs, which apparently consist of an unreduced vowel and a glide, and runs into the obstacle of the complete non-occurrence of nasal diphthongs alternating with any other vocalic configurations. The previous chapter has described the conditions which evidently account for glide formation in

Portuguese. The total generality of this description may be employed to describe glide formation in nasal diphthongs as well as in oral diphthongs, due to the basic similarity of both forms of diphthongs. It is therefore proposed that the surface glide appearing in Portuguese nasal diphthongs follows as the natural result of a high, unstressed base element in contact with a lower (or stressed) vocalic segment.

Combining the notions discussed in the preceding paragraphs, namely the fact that Portuguese nasal diphthongs may be considered to arise from a stored form consisting of a mid or low vowel in contact with an unstressed high segment and that both of the elements underlying the diphthong are simultaneously nasalized by a following nasal segment, calls for a total reformulation of the general nasalization rule as proposed in (5) above. The Portuguese nasalization rule as conceived of in this section must account not only for the nasalization of single vowels, but also for the nasalization of both elements of a diphthong. The basic nasalization rule must therefore be of the form:

$$(13) \quad \underset{1}{V} \left(\underset{2}{\begin{bmatrix} -\text{cons} \\ +\text{high} \\ -\text{stress} \end{bmatrix}} \right) \underset{3}{\begin{bmatrix} C \\ +\text{nas} \end{bmatrix}} \underset{4}{C_1 \#} \rightarrow \underset{1}{\begin{bmatrix} V \\ +\text{nas} \end{bmatrix}} \left(\underset{2}{\begin{bmatrix} -\text{voc} \\ +\text{nas} \end{bmatrix}} \right) \emptyset, \quad 4$$

It will be noticed that the glide formation condition is subsumed by (13). This notation has been employed in order to demonstrate the fact that unstressed nonconsonantal high segments always become glides when contiguous to a vowel. It is not intended to imply that glide formation in Portuguese takes place in different manners or at different times, but

is merely included as a reminder that the various general or predictable conditions of Portuguese phonology are taken to be a single decision function through which the underlying forms are passed. For the sake of intelligibility, the elements of Portuguese phonology as described in the present study cannot be presented as a single operation, but must instead be broken into component parts for ease of analysis. The fundamental concept remains, nonetheless, that of an unordered and simultaneously-applying phonological filter, which emits only acceptable Portuguese surface forms.

4.8. Homorganic assimilation

A remark should be made at this point about the statement often heard that when a Portuguese nasal vowel is followed in the same syllable by a nasal consonant, the nasal consonant is dropped only if the following consonant is a continuant (cf. Saciuk 1970: 198). Such a description is fundamentally inaccurate. What happens in reality is not a retention of nasal consonants before stops, but rather a prenasalization of the consonant immediately following the nasal vowel. The fact that the consonant following the nasal vowel is usually homorganic to the orthographically indicated nasal consonant has led to the mistaken impression that has just been mentioned. It is this confusion which led Hall (1943a, b) and Feldman (1967) to postulate the phonemes /ⁿd/, /^mb/, /^ŋg/, etc. Modern analyses have conclusively demonstrated that prenasalization takes place (cf. Morais-Barbosa 1961, Head 1965). In fact, Head (p. 189) has shown that the phenomenon occurs with the continuant

consonants as well as with the stops.

4.9. The full extent of nasalization

The data presented in this chapter up to this point constitute a complete description of the phenomenon of vowel nasalization in Brazilian Portuguese in those cases where the nasal vowels appear to be analyzable as being followed in the same syllable by a nasal consonant. Since it is solely in these positions where phonemic nasal vowels occur in Portuguese, the description of vowel nasalization could be terminated at this point. To do so, however, would be to fail to describe the phenomenon of vowel nasalization in its fullest generality. Although the phonemic contrast between nasal vowels and corresponding oral vowels only occurs when the vowel is followed phonetically either by a consonant or by a word boundary, vowel nasalization in the cariocan dialect is not confined to these positions. It is a commonly observed fact that in most dialects of Portuguese vowel nasalization occurs more or less generally whenever a vowel is followed by a nasal consonant, regardless of the syllabic structure. Since no phonemic contrast results when the nasal consonant is in the following syllable, this observation is usually awarded no more than a passing comment. It has been the observation of the present investigator that vowel nasalization in Brazilian Portuguese occurs regularly when [a] is followed by a nasal consonant in the next syllable, and also when any vowel is followed by [ɲ]. Such vowel nasalizations are not restricted to the above instances, however, but also occur, with somewhat diminished

regularity, throughout the language. Examples are:

<u>cama</u>	[kãmɐ]	'bed'
<u>tenho</u>	[tẽnu]	'I have'
<u>como</u>	[kõmu]	'how'
<u>cima</u>	[sĩmɐ]	'top'

It is the case that vowel nasalization before a nasal consonant in the following syllable is an acceptable and usually unnoticed variation in Brazilian Portuguese. A refusal to consider such a phenomenon, even though it does not play a distinctive role in the carioca dialect, would be a refusal to admit the most general source of vowel nasalization: contact with a nasal consonant. Although nasalization of vowels before nasal consonants in the following syllable has not been completely generalized in the carioca dialect, its present frequency and apparent spread demand that it be taken into consideration in any sort of rule or condition claiming to describe the language. By considering such a phenomenon, one can adequately demonstrate that vowel nasalization is, in Brazilian Portuguese, a regular process conditioned in general only by the presence of nasal consonantal segments. The retention or deletion of the nasal consonant is, in turn, dependent only on the following segments.

Since the process of vowel nasalization described above is not totally regular without exception in Brazilian Portuguese, one is faced with the problem of how to incorporate the phenomenon into the general nasalization process described thus far. One could always mark such occurrences of nasal vowels as exceptions to the general nasalization condition, thus necessitating a series of statements

which indicate when these nasalizations occur and when they do not occur. Since such occurrences are not totally predictable, this is tantamount to requiring a listing of the entire portion of the Brazilian Portuguese vocabulary containing instances of vowels followed in the next syllable by a nasal consonant. Such a description would be a denial of the most general form of vowel nasalization. A much more suitable assumption, and one more in keeping with the observed facts, would be that the nasalization process in its most general form, that is, that vowels are nasalized whenever followed by a nasal consonant, exists as an active process in Brazilian Portuguese, and that its domain has not yet been extended to every possible instance where it could operate. Such a technique has been utilized by Schane (1970) in dealing with vowel nasalization in French. Brazilian Portuguese is a language in which subphonemic distinctions are often retained for purposes of style and subtlty (cf. Jucá 1961). This fact, as well as other social factors may have some bearing on the fact that not all vowels followed by a nasal consonant appear in a nasalized form. All available data point, however, to the process of nasalization being extended in the carioca dialect to its most general form. Therefore, the following condition is proposed to describe vowel nasalization in Brazilian Portuguese in all of its aspects:

$$(14) \quad \underset{1}{V} \left(\underset{2}{\begin{bmatrix} -\text{cons} \\ +\text{high} \\ -\text{stress} \end{bmatrix}} \right) \underset{3}{\begin{bmatrix} C \\ +\text{nas} \end{bmatrix}} \left[\underset{4}{\begin{bmatrix} \{C_1\} \\ \# \\ V \end{bmatrix}} \right] \rightarrow \underset{1}{\begin{bmatrix} V \\ +\text{nas} \end{bmatrix}} \left(\underset{2}{\begin{bmatrix} -\text{voc} \\ +\text{nas} \end{bmatrix}} \right) \begin{bmatrix} \emptyset \\ 3 \end{bmatrix} \quad 4$$

Conditions (8) and (11) are also assumed to apply to (14).

FOOTNOTES

1. Lüdtke (1953: 213) gives a detailed argument in favor of phonemic nasal vowels in Iberian Portuguese based on this example.
2. The needs of considering such a heterogeneous speech community as the basis of a linguistic investigation are considered in Weinreich, Labov and Herzog (1968).
3. Cf. Williams (1962: 70-73, 90-91).
4. See Ferguson (1963).
5. Rochet (1970) questions the validity of this claim for the French and Portuguese nasal vowels.
6. See, for example, Dahl (1964: 316).

CHAPTER FIVE

THE CONSONANTS

5.1. A descriptive introduction

This chapter is concerned with describing the most commonly occurring consonantal phenomena of Brazilian Portuguese. Choosing a set of distinctive features for the Portuguese consonants is a relatively easy task, due in part to the absence of phonetically unusual consonantal variations in the carioca dialect, and also to the greater general agreement over the distinctive features used to specify consonants. Head (1965), using basically Jakobson's distinctive features, has analyzed the principal consonantal segments of Portuguese as illustrated below:

	p	b	f	v	m	t	d	s	z	n
comp.	-	-	-	-	-	-	-	-	-	-
grave	+	+	+	+	+	-	-	-	-	-
tense	+	-	+	-	-	+	-	+	-	-
cont.	-	-	+	+	-	-	-	+	+	-
strid.	-	-	+	-	-	-	-	+	+	-
nas.	-	-	-	-	+	-	-	-	-	+

	t'	d'	š	ž	č	ǰ	ɲ	λ	k	g	x
comp.	+	+	+	+	+	+	+	+	+	+	+
grave	-	-	-	-	-	-	-	-	+	+	+
tense	+	-	+	-	+	-	-	-	+	-	+
cont.	-	-	+	+	-	-	-	+	-	-	+
strid.	-	-	+	+	+	+	-	-	-	-	+
nas.	-	-	-	-	-	-	+	-	-	-	-

With the exception of [t'] and [č] which are variants of /t/, and [d'] and [ǰ] which are variants of /d/, all of the above segments may enter into phonemic oppositions in the carioca dialect. It is to be noticed that in order to represent the two successive stages of palatalization of

/t+i/ to [t'i] and [či], one has recourse only to the feature 'strident' to distinguish these phones with differing points of articulation. The same distinction is true for the parallel palatalization of /d+i/ to [d'i] and [ji].

The other complete set of distinctive features for consonants is the features proposed by Chomsky and Halle (1968), which yields the following description (including the liquid segments not covered by Head's analysis):

	r	l	p	b	f	v	m	t	d	s	z	n
voc.	+	+	-	-	-	-	-	-	-	-	-	-
cons.	+	+	+	+	+	+	+	+	+	+	+	+
high	-	-	-	-	-	-	-	-	-	-	-	-
back	-	-	-	-	-	-	-	-	-	-	-	-
ant.	+	+	+	+	+	+	+	+	+	+	+	+
cor.	+	+	-	-	-	-	-	+	+	+	+	+
vce.	+	+	-	-	-	-	-	-	-	-	-	-
cont.	-	+	-	-	+	+	-	-	-	+	+	-
nas	-	-	-	-	-	-	+	-	-	-	-	+
	t'	d'	š	ž	č	ǰ	ɲ	λ	k	g	x	
voc.	-	-	-	-	-	-	-	+	-	-	-	
cons.	+	+	+	+	+	+	+	+	+	+	+	
high.	+	+	+	+	+	+	+	+	+	+	+	
back	-	-	-	-	-	-	-	-	+	+	+	
ant.	+	+	-	-	-	-	-	-	-	-	-	
cor.	+	+	+	+	+	+	+	+	-	-	-	
vce.	-	-	-	-	-	-	-	-	-	-	-	
cont.	-	-	+	+	-	-	-	+	-	-	+	
nas.	-	-	-	-	-	-	+	-	-	-	-	

In this framework, the first stage of palatalization of /ti/, to [t'i] and of /di/ to [d'i] is shown as assimilation from -high to +high. a description which clearly indicates palatalization. The second stage of palatalization, to [či] and to [ji] is shown by the change from +ant to -ant, which reflects the retracted point of articulation of the palatal affricates. As a result of this more adequate description,

as well as a generally more accurate description possible through the use of oral-articulatory features, the Chomsky-Halle distinctive features will be employed for the description of consonantal segments throughout the present chapter.

It will be noted that some feature names, for example 'high,' are used here in describing both the vowels and the consonants. However, except for obvious cases such as nasalization, no universality of features for both vowels and consonants is claimed.¹ In the particular case of the feature 'high,' the similarity of terms is in part coincidental, since in describing the vowels the feature refers to a specific subdivision of the vertical axis of the mouth, while in describing the consonants, the feature 'high' refers explicitly to the tongue position against the roof of the mouth.

5.2. Palatalization of /t/ and /d/

The first consonantal phenomenon to be studied is the palatalization of /ti/ to [t'i] or [či] and of /di/ to [d'i] or [ji]. This phenomenon represents basically two successive stages of palatalization, and the carioca dialect is characterized by the complete passage to the palatal affricates. The phones [t'] and [d'] are also heard in this dialect, and are considered acceptable variants, since the perceptual difference between the two sets of variants is minimal. Since before /i/ there is no possibility of contrast between [t], [t'], and [č], or between [d], [d'], and [j], there seems to be no justification for establishing underlying palatal or palatalized consonants. Conversely,

since [t] or [d] never appear before [i] in the carioca dialect, it seems unwise to consider the presence of underlying completely specified /t/ and /d/ before /i/. What is needed is a redundancy condition which will adequately demonstrate the fact that before /i/, only certain variants may occur.

What is involved in the so-called palatalization of t and d in cariocan Portuguese is really a two-stage process. The first step, common to all speakers of the dialect, specifies (orthographic) t and d before [i] as [t'] and [d'] . Such a step may be covered by a rule such as:

$$(1) \quad \begin{bmatrix} +\text{ant} \\ +\text{cor} \\ -\text{cont} \\ -\text{nas} \end{bmatrix} \rightarrow [+high] / \text{ — } \begin{bmatrix} \text{V} \\ +\text{front} \\ +\text{high} \\ -\text{mid} \end{bmatrix}$$

The second stage of the palatalization process is the change to the palatal affricates [t͡ʃ] and [d͡ʒ] . It is a general but not mandatory phenomenon in the carioca dialect, hence the observable variation between the two sets of palatalized variants. This second stage may be shown as follows:

$$(2) \quad \begin{bmatrix} +\text{ant} \\ +\text{cor} \\ -\text{cont} \\ +\text{high} \end{bmatrix} \rightarrow [-\text{ant}]$$

While the complete change to the palatal affricates is not mandatory, the two stages as described above should be viewed not as two separate processes, but rather as a single palatalization phenomenon, the total application of which is optional to each individual speaker. For this reason, (1) and (2) should be combined into a single redundancy condition which will portray the variability of palatalization

in the carioca dialect. Such a description is offered by:

$$(3) \quad \left[\begin{array}{l} +\text{cor} \\ -\text{nas} \\ -\text{cont} \end{array} \right] \rightarrow [+high] / \text{---} \left[\begin{array}{l} \text{V} \\ +\text{front} \\ +\text{high} \\ -\text{mid} \end{array} \right]$$

The condition expressed by (3) is, as it now stands, too restrictive, since it calls for the palatalization process to occur only before a fully specified high front vowel. However, the presence of palatalized segments in other forms shows that palatalization occurs before any unstressed front vowel, and that specifying the vowel in (3) as +front, -mid in all cases is merely a repetition of the condition of unstressed vowel raising. Examples:

<u>antes</u>	[ẽnc'is]	'before'
<u>cidade</u>	[sidã'ji]	'city'

Therefore, condition (3) must be modified slightly so as to fully specify the vowel only in stressed position:

$$(4) \quad \left[\begin{array}{l} +\text{cor} \\ -\text{cont} \\ -\text{nas} \end{array} \right] \rightarrow [+high] / \text{---} \left[\begin{array}{l} \text{V} \\ +\text{front} \\ \langle +\text{high} \rangle \\ \langle +\text{mid} \rangle \\ \langle -\text{stress} \rangle \end{array} \right]$$

Condition (4) as stated above portrays as accurately as possible the fact that palatalization before [i] which occurs in the carioca dialect is the result of a phonological redundancy. Moreover, it mirrors the possibility of choice between [t'] and [d'], which are +anterior, and [č] and [j] which are -anterior.

5.3. The palatal resonants

Another topic to be investigated is the analysis of the palatal consonants [ɲ] and [ʎ]. In Brazilian Portuguese, the pairs [n]/[ɲ] and [l]/[ʎ] enter into phonemic oppositions,

as illustrated below:

<u>ano</u>	[ẽnu]	'year'
<u>anho</u>	[ẽɲu]	'lamb'
<u>filo</u>	[fílu]	'thread'
<u>filho</u>	[fíλu]	'son'

The question remains, however, as to whether [ɲ] and [λ] are to be analyzed as independent phonemic entities, or merely as positional variants of /n/ and /l/ before /i/ in a manner similar to the analysis of the preceding section. That they cannot be analyzed merely as palatalized variants of /n/ and /l/ before surface [i] in a manner similar to the analysis of the palatalization of /t/ and /d/ is evident from the observed phonemic contrasts illustrated above.

An analysis of this problem must be carried out under the same cautions recognized in the study of vowel nasalization. There is a possibility that degree of literacy has a bearing on the individual speaker's analysis of [ɲ] and [λ], since both phones are represented orthographically by two letters, lh and nh, respectively. In addition, the unstable and sporadic surface representations of these two phones further increases the difficulty of an accurate analysis. As in the case of vowel nasalization, considerable experimental work must be done before conclusive results may be obtained. The analysis presented below is not to be construed as an interpretation valid for the entire carioca dialect, but rather as a possible direction for future investigation.

In a negative response to a diphonemic analysis of [ɲ] and [λ], Head (1965) offers the following supposedly minimal

pairs where the phonetic contrast [ɲ]/[ɲj] and [λ]/[lj] are exhibited:

<u>venha</u>	[vɛ̃ɲɐ]	'that he come'
<u>vênia</u>	[vɛ̃ɲjɐ]	'permission'
<u>ôlhos</u>	[óλus]	'eyes'
<u>ôleos</u>	[óljus]	'oils'

Such an example appears, however, to be one of the often-cited artificial distinctions on which phonemic analyses should not be based. The present investigator has never observed the above distinction actualized (the above minimal pairs, the only common ones which even exist, stand small chance of being contextually confused). The realized variants of /ɲj/ and /lj/ have always emerged as [ɲ] and [λ]. In addition, aside from the almost total lack of minimal pairs, there are almost no orthographic occurrences in Portuguese which would call for the sequences [ɲj] or [lj]. As a result of these observations, the analysis of [ɲ] and [λ] as being positional variants of /n/ and /l/ remains open for further investigation.

Harms (1966, 1968) has proposed a formal decision procedure for arriving at the more desirable solution in cases such as the present one. More specifically, Harms (1968: 87) proposes the following analysis. Considering a given segment X to result phonologically from a cluster of two underlying segments a and b requires that each occurrence of X must be considered as consisting of the number n of features required to specify a plus the number m of features needed to specify b, for a total of n+m features. On the other hand, considering X to be phonolo-

gically a single segment requires that it be considered to consist of the number of features n needed to specify the 'base' element a plus the additional qualifying feature needed to arrive at the full specification of X (considering b as the 'qualifying' segment such as palatalization or aspiration), or n+1 features. However, for purposes of comparison, the element a occurring by itself must be specified as minus the qualifying feature, so it too must be considered as having n+1 features. Therefore, one arrives at the more 'economical' description by a comparison of the results obtained by the following computation:

	<u>unit solution</u>	<u>cluster solution</u>
P instances of <u>X</u>	P(n+1) features	P(n+m) features
Q instances of <u>a</u>	Q(n+1) features	Qn features
<u>total</u>	(P+Q)(n+1) features	(P+Q)n + Pm features

Although no accurate count of the occurrences of [ɲ] and [λ] in Brazilian Portuguese exists, [n] and [l] occur more frequently. A reasonable estimate would predict somewhat less than 1/5 as many occurrences of [ɲ] and [λ] than of [n] or [l].² Taking there to be, for example, 50 occurrences of [ɲ] and 250 occurrences of [n], the analysis proposed by Harms would proceed as follows. Either of the segments [n] or [l] may be described by 3 features. Four features are needed to describe the palatalized [ɲ] and [λ]. Therefore, in the comparison, 4 features will be needed to specify [n] and [l]. The segment [j] may also be described by 3 features. Therefore, the following comparison ensues, based on Harms' formal procedure:

	<u>unit solution</u>	<u>cluster solution</u>
[n]	50(4) = 200	50(6) = 300
[ɲ]	250(4) = 1000	250(3) = 750
total	1200	1050

Thus, in this instance, the cluster solution would yield the more 'economical' solution for the phonemic analysis of [n] and [ɲ]. It will be noted, however, that purely from the mathematical structure of the above formula, whenever the frequency of occurrence of the palatal resonants falls below half that of the corresponding non-palatal resonant, the cluster solution will automatically emerge as the more 'economical' one.

While a formula such as the one above provides a formal decision procedure for the formation of an optimal abstract lexicon, it says little or nothing about the actual nature of Portuguese [n] and [ɲ]. Some evidence can, nonetheless, be brought forward which points to an analysis of [n] and [ɲ] as being derived from two underlying segments, in the grammars of some speakers.

In the previous chapter it was noted that in the carioca dialect, vowel nasalization is completely regular before [ɲ], in fact it is only before [ɲ] that all vowels are regularly nasalized when followed in the same syllable by a nasal consonant. In addition, it is commonly observed in carioca speech that [ɲ] is often reduced merely to a nasalized glide [j̃] as illustrated below:

<u>senhor</u>	[sĩj̃ór]	'sir'
<u>tenho</u>	[tẽju]	'I have'
<u>ponho</u>	[põju]	'I put'
<u>espanha</u>	[isp̃ẽj̃v]	'Spain'

Such a phenomenon points to the possibility that in many idiolects, [ɲ] is analyzed as /nj/, and consequently the portion of the general nasalization rule dropping the nasal consonant when followed by another nonvocalic segment is applied to occurrences of [ɲ] .

There are two phenomena which suggest that Brazilian Portuguese [λ] is also analyzed by many speakers as containing two elements. The first is the loss of palatalization in such words as the dative pronouns lhe and lhes, as illustrated below:

<u>lhe</u>	[li]
<u>lhes</u>	[lis]

The second point to be considered is the widespread loss of the lateral element of [λ] , paralleling the development of Andalusian and American Spanish and Parisian French. Commonly heard examples are:

<u>mulher</u>	[mujé]	'woman'
<u>filho</u>	[fíju]	'son'
<u>trabalhar</u>	[trɐbɐjár]	'to work'

The two preceding paragraphs have presented observations that seem to indicate that some speakers of the carioca dialect may analyze [ɲ] and [λ] as /nj/ and /lj/, respectively. While these points do not constitute a conclusive argument as to the nature of the palatal resonants, they call for the proposal of a condition which may be present in the grammars of many cariocan speakers which would palatalize /n/ and /l/ before a front glide, subsequently deleting this glide. This condition is of the form:

$$(5) \quad \left[\begin{array}{c} +\text{cons} \\ \alpha \text{ voc} \\ \alpha \text{ cont} \\ -\alpha \text{ nas} \\ +\text{cor} \end{array} \right] \left[\begin{array}{c} -\text{cons} \\ +\text{high} \\ +\text{front} \\ -\text{stress} \end{array} \right] \rightarrow \left[\begin{array}{c} -\text{ant} \\ +\text{cor} \\ +\text{high} \end{array} \right] \emptyset, \quad 3$$

It must again be emphasized that (5) has not at the present time been shown to be valid for large segments of the Brazilian population, but rather is indicated only in certain instances. It remains for future developments, perhaps psycholinguistic investigations or the observation of current sound change, to pass final judgement on the validity of the analysis given above.

5.4. Syllable-final sibilants

Another phenomenon characteristic of the carioca dialect and often considered as a palatalization process is the change of syllable-final /s/ and /z/ to [š] and [ž]. This phenomenon, often equated by outsiders with the speech of all of Brazil, is restricted in its general occurrence to the city of Rio de Janeiro. Furthermore, within the carioca dialect, its use is optional, even within individual idiolects. The same speaker may successively palatalize or leave unchanged syllable-final s and z, even within the same set of words. Within the carioca dialect, this phenomenon is considered by some people to be an indication of affected or feminine speech and it has been the observation of the present investigator that it occurs more often in the speech of women. This phenomenon may, however, be observed in the speech of all classes of cariocan speakers.

It seems that the palatalization of syllable-final s and z should be considered the result of a redundancy condition, since there is no possibility of contrast in this position. It is the employment of this redundancy condition which constitutes the variable that accounts for the sporadic

nature of its occurrence. The choice of whether or not to apply such a condition seems totally dictated by the whim of the individual speaker, influenced, of course, by a variety of social and cultural factors. Such a redundancy condition would, in its simplest form, be presented as:

$$(6) \quad \begin{bmatrix} +\text{cor} \\ +\text{cont} \end{bmatrix} \rightarrow [-\text{ant}] / \text{---} \left\{ \begin{array}{c} \# \\ c_1 \end{array} \right\}$$

This formulation is, however, far from complete. The first fact to be considered is that word-final /s/ or /z/ does not palatalize when the following word begins with a vowel:

<u>as</u> <u>arv</u> ores	[azárvur ^{is}]	'the trees'
<u>os</u> <u>out</u> ros	[uzótr ^{us}]	'the others'

Rule (6) must therefore be modified to include this restriction:

$$(7) \quad \begin{bmatrix} +\text{cor} \\ +\text{cont} \end{bmatrix} \rightarrow [-\text{ant}] / \text{---} \left\{ \begin{array}{c} (\#)c_1 \\ \#\# \end{array} \right\}$$

The statement expressed by (7) is almost complete, except for a single detail. Syllable-final /s/ agrees in voice with the following segment. This voicing agreement occurs whether or not a word boundary intervenes:

<u>as</u> <u>mes</u> mas	[azmézm ^{rs}]	'the same ones'
<u>hos</u> pital	[ospitáw]	'hospital'

Condition (7) must consequently be amended to include voicing assimilation and thus to describe the conditions of the palatalization of syllable-final sibilants:

$$(8) \quad \begin{bmatrix} +\text{cor} \\ +\text{cont} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{ant} \\ \text{vce} \end{bmatrix} / \left\{ \begin{array}{c} (\#) \begin{bmatrix} c \\ \text{vce} \end{bmatrix} \\ \#\# \end{array} \right\}$$

It becomes evident that in the cases of words containing initial clusters of s plus consonant, to which an epenthetic

e is prefixed as described in Chapter Two, the set of output constraints must apply twice. In the first application, the initial e is prefixed to the non-permissable initial cluster. The second application palatalizes the resulting syllable-final s. It is noticed that the two rules need not be extrinsically ordered, since (8) is satisfied only after the prefixing of initial e.

5.5. Sibilant voicing assimilation

One often encounters the statement in early descriptions of the language that Portuguese intervocalic /s/ becomes voiced to [z]. This statement is doubtless influenced by the orthography, since intervocalic -ss- is always pronounced [s] and intervocalic -s- is usually pronounced [z]. It is the case, however, that phonetically, intervocalic [s] and [z] may enter into phonemic oppositions:

<u>casa</u>	[káʒɐ]	'house'
<u>caça</u>	[káʂɐ]	'he hunts'

Portuguese /s/ does, however, enter into some voicing assimilations, as will be investigated in this section.

The first instance of voicing assimilation is the case where /s/ is in contact with a following consonant. Voicing assimilation to the following consonant occurs in this case whether or not a word boundary intervenes. This is merely a partially reformulated version of (8) above, but it is general even if the optional palatalization is not applied. This voicing assimilation may be stated as:

$$(9) \begin{bmatrix} +ant \\ +cor \\ +cont \end{bmatrix} \rightarrow [\alpha vce] / \text{---}(\#) \begin{bmatrix} C \\ \alpha vce \end{bmatrix}$$

The opposite environment, namely $V\#$ V , does not constitute

a valid environment for voicing assimilation:

a cidade [asidáʝi] 'the city'

Although word-internal intervocalic /s/ is not affected by voicing assimilation, word-final /s/ is realized as [z] when the following word begins with a vowel:

as outras [azótrɐs] 'the others'
os índios [uzíʝjus] 'the indians'

This voicing assimilation may be described by the following condition:

$$(10) \quad \begin{bmatrix} +\text{ant} \\ +\text{cor} \\ +\text{cont} \end{bmatrix} \rightarrow [+vce] / V _____\#V$$

Statements (9) and (10) are both variants of a general process of voicing assimilation of /s/ to the following segment. For this reason, they may be compressed into a single condition of voicing assimilation, which would include the restrictions on word-internal intervocalic /s/. This would then be a redundancy condition of the form:

$$(11) \quad \begin{bmatrix} +\text{ant} \\ +\text{cor} \\ +\text{cont} \end{bmatrix} \rightarrow [\alpha vce] / V _____\left\{ \begin{array}{l} \langle \# \rangle \\ (\#) \end{array} \begin{bmatrix} \langle V \rangle \\ [\alpha vce] \end{bmatrix} \right\}$$

Condition (11) expresses the generality that /s/ agrees in voice with the following segment, except for word-internal intervocalic position. In addition, it explains the fact that the phrase-final neutralization of /s/ and /z/ favors the voiceless member:

o rapaz [u xɐpás] 'the boy'
os rapazes [uzxapázis] 'the boys'

5.6. Syllable-final /l/

It is a commonly observed characteristic of the carioca dialect that the syllable final 'dark' l, common to most

dialects of Portuguese, is vocalized to [w]:

<u>Brasil</u>	[brɛ zɨw]	'Brazil'
<u>salto</u>	[sáwtu]	'heel'

Due to the fact that this phenomenon occurs regularly in the carioca dialect, it would appear that the 'vocalization of l' is merely the result of a general redundancy condition. Since the only other true liquid in Brazilian Portuguese, namely [r], does not occur in syllable-final position, being replaced instead by the velar fricative [x], this redundancy condition would take the form of a prohibition of liquids in syllable-final position:

$$(12) \quad [+cons] \rightarrow [-voc] / \text{_____} \begin{Bmatrix} \# \\ C_1 \end{Bmatrix}$$

Such a statement fails to take into account the instances of alternation between [w] and [l] in forms derived from words ending in orthographic l:

<u>Brasil</u>	[brɛ sɨw]	'Brazil'
<u>brasileiro</u>	[brasiléjru]	'Brazilian'

In these cases, a rule is apparently called for which converts syllable-final /l/ to [w] and leaves other instances of /l/ intact:

$$(13) \quad \begin{Bmatrix} +cons \\ +voc \\ -ant \end{Bmatrix} \rightarrow \begin{Bmatrix} -cons \\ -voc \\ +back \end{Bmatrix} / \text{_____} \begin{Bmatrix} C_1 \\ \# \end{Bmatrix}$$

/l/ is here specified as -ant, since in syllable-final position, it is 'dark' throughout the Portuguese-speaking world, as a general characteristic of the language. It must be noted that the word boundary cannot be deleted from (13) where the following word begins with a vowel:

<u>fuzil</u> <u>antigo</u>	[fuziw ẽ čígu]	'old rifle'
<u>canal</u> <u>ancho</u>	[kɛnáv ẽ šu]	'wide canal'

This is due to the general redundancy condition given in (12) which apparently takes precedence except in those cases of the addition of derivational affixes, where rule (13) applies. It is noticed that in the carioca dialect, there is often no way of determining from the surface form of a word whether it ends in /l/ or non-syllabic /u/:

<u>paul</u>	[paw]	'swamp'
<u>pau</u>	[paw]	'club'

This phonetic confusion often leads to errors in perception and orthography, such as *polpa for popa, *caução for calção, etc. (cf. Mattoso Câmara 1957: 283).

5.7. The distribution of /x/

The other problem in the analysis of the Portuguese liquids is the status, in the carioca dialect, between so-called 'single r' and 'double r.' In the carioca dialect, the liquid [r], a voiced single alveolar trill, may occur only in intervocalic position. In word-initial and syllable-final position, only the velar fricative[x], which may be either voiced or voiceless, is found. The only possibility for contrast between these two segments is in intervocalic position, yielding minimal pairs like the following:

<u>caro</u>	'dear'
<u>carro</u>	'car'
<u>era</u>	'era'
<u>erra</u>	'he errs'
<u>muro</u>	'wall'
<u>murro</u>	'punch'

Such apparent contrasts have led many investigators, including Head (1965), to posit two separate phonemes /r/ and /rr/, with contrast possible only intervocalically.

While such an analysis is of course possible, the conception of two separate phonemes which contrast only in intervocalic position is not in keeping with the general phonological structure of Portuguese, where maximum differentiation is generally possible in initial position.

Another possible analysis of the contrast only in intervocalic position of [r] and [x] is to analyze intervocalic [x] as geminate /xx/.³ Since the first /x/ of such a cluster would be syllable-final and the second would consequently be syllable-initial, the phonetic result would be [x] for each occurrence of underlying /x/. The fact that the [x] which occurs intervocalically is of no longer duration than the occurrences of the same sound word-initially or word-finally may be explained by the fact that phonetic gemination is not permitted in Portuguese, for example:

<u>para a</u> (often spelled <u>pra</u>)	[pra]	'along the'
<u>as cidades</u>	[asida ^ː jis]	'the cities'

This is a completely general phenomenon in the carioca dialect and may be expressed as:

(14) XX \longrightarrow X where X is any segment

Bearing this in mind, intervocalic [x] may be analyzed as geminate /xx/, with the result that the language must be considered to possess a rule which converts underlying /x/ to [r] in intervocalic position:

(15) $\left[\begin{array}{c} \text{C} \\ +\text{high} \\ +\text{back} \\ +\text{cont} \end{array} \right] \left[\begin{array}{c} -\text{high} \\ +\text{voc} \\ -\text{high} \\ -\text{back} \end{array} \right] / \text{V} \underline{\quad} \text{V}$

While the statement made in (15), coupled with the general phenomenon covered by (14), does indeed provide an

interpretation of the intervocalic contrast of [x] and [r], it is not as yet sufficiently well motivated to be considered a definitive analysis. The above analysis may be shown to have a measure of explanatory value in relation to the entire system of Brazilian Portuguese phonology by considering the behavior of /x/ in word-final position. When /x/ occurs word-finally before a pause or before a word beginning with a consonant, it is realized as [x] (or, in colloquial speech, often dropped). However, when the word following the instance of word-final /x/ begins with a vowel, word-final /x/ is changed to [r]:

<u>mulher</u>	[muléx]	'woman'
<u>mulher</u> <u>alta</u>	[mulɛráwtɐ]	'tall woman'

This phenomenon also occurs across morpheme boundaries:

<u>mulher</u>	[muléx]	'woman'
<u>mulheres</u>	[muléris]	'women'

Such a phenomenon appears to be a generalization of the conversion of intervocalic /x/ to [r] to the case where a word or morpheme boundary intervenes before the second vowel, and therefore lends some measure of support to the analysis proposed above. As in the case of voicing of word-final s, word-initial /x/ is not affected:

<u>a</u> <u>rua</u>	[axúɐ]	'the street'
<u>o</u> <u>radio</u>	[uxáʃu]	'the radio'

Combining all the observations made above results in the following statement of the distribution of /x/:

$$(16) \quad \left[\begin{array}{c} \text{C} \\ +\text{high} \\ +\text{back} \\ +\text{cont} \end{array} \right] \rightarrow \left[\begin{array}{c} +\text{voc} \\ -\text{high} \\ -\text{back} \\ +\text{cont} \end{array} \right] / \text{V} _____ (+)\text{V}$$

A possible explanation of the failure to completely generalize (16) to occurrences of word-initial /x/ may lie in the fact

that in the carioca dialect, syllable-final [x] is articulated very weakly, often dropped, while in word-initial position it is articulated with great energy.

5.8. Plural formation

The final topic to be investigated in the present study is the process of noun and adjective pluralization. Although generally felt to be morphophonemic in nature, the Brazilian Portuguese pluralization process has motivated several recent generative phonological studies which have derived consequences of a more general nature. For this reason, the subject of noun and adjective pluralization will be briefly examined in this section, and an attempt will be made to determine the extent to which a plural form may be adequately described by the methods heretofore employed in this study.

Traditionally, descriptions of Portuguese describe the process of pluralization as being divided into six main categories, as illustrated below:

I. Words ending in a vowel form their plural by adding -s:

<u>o livro</u>	'the book'
<u>os livros</u>	'the books'
<u>a cama</u>	'the bed'
<u>as camas</u>	'the beds'
<u>a cidade</u>	'the city'
<u>as cidades</u>	'the cities'

II. Words ending in -r, -z, or in -s with oxytonic accent add -es to form the plural:

<u>o favor</u>	'the favor'
<u>os favores</u>	'the favors'
<u>o rapaz</u>	'the boy'
<u>os rapazes</u>	'the boys'

<u>o país</u>	'the country'
<u>os países</u>	'the countries'

III. Words ending in -s whose final syllable is unaccented remain unchanged in the plural:

<u>o lápis</u>	'the pencil'
<u>os lápis</u>	'the pencils'

<u>o ônibus</u>	'the bus'
<u>os ônibus</u>	'the busses'

IV. Words ending in -l form their plural in one of three ways:

a. words ending in -al, -el, -ol, or -ul drop the l and add -is in the plural:

<u>o canal</u>	'the canal'
<u>os canais</u>	'the canals'

<u>o papel</u>	'the paper'
<u>os papeis</u>	'the papers'

<u>o farol</u>	'the headlight'
<u>os faróis</u>	'the headlights'

<u>o paul</u>	'the swamp'
<u>os pauis</u>	'the swamps'

b. words ending in accented -il drop the l and add s:

<u>o fuzil</u>	'the rifle'
<u>os fuzis</u>	'the rifles'

c. words ending in unaccented -il drop the il and add eis:

<u>automóvil</u>	'automobile'
<u>automóveis</u>	'automobiles'

V. Words ending in m or n form their plurals by changing the m to n and adding s:

<u>o homem</u>	'the man'
<u>os homens</u>	'the men'

<u>o hífen</u>	'the hyphen'
<u>os hífenis</u>	the hyphens'

VI. Words ending in -ão form their plural in any one of the following three ways, depending on the individual word:

a. by simply adding -s:

<u>o cristão</u>	'the Christian'
<u>os cristãos</u>	'the Christians'

b. by changing ão to ães:

<u>o</u> <u>cão</u>	'the dog'
<u>os</u> <u>cães</u>	'the dogs'

c. by changing ão to ões:

<u>a</u> <u>nação</u>	'the nation'
<u>as</u> <u>nações</u>	'the nations'

Such a variety of possibilities in the formation of plurals, together with the occurrence of -s at the end of every plural form has inspired several generative phonological accounts of Portuguese pluralization in which the plural morpheme, taken unanimously to be /-s/, is affixed to various underlying forms with a system of ordered rules then required to derive the proper surface forms. The present investigation has considered the format of ordered rules to be a counter-intuitive and unnecessary apparatus. Therefore, the formation of plurals in Portuguese will be considered in the light of an unordered set of output constraints which may be applied by the speaker in response to generalizations which he has extracted about his language.

All previous studies of the pluralization process in Portuguese have agreed that for the words of class I above, the plural may be formed by adding the morpheme /-s/ to the underlying stem-final vowel. In the case of the words of class II, ending in a consonant, the need has been felt to posit underlying stem forms ending in /-e/. This /-e/ is then deleted by a rule of apocope and appears in the plural form together with the plural morpheme to provide the surface ending [is]. Thus one finds underlying representations of the following form;

<u>favor</u>	/favore/	'favor'
<u>rapaz</u>	/rapaze/	'boy'
<u>pais</u>	/paise/	'country'

Such a presentation, while providing a possible description, leaves the problem of the phonetically unrealized /e/, together with the apocope rule which removes the /e/ phonetically from the singular form. No reason is offered for the non-occurrence phonetically of the posited underlying final /e/, but rather an apocopation rule is presented, necessitated solely to provide a neat description of the plural forms, which must remove this hypothesized vowel from the surface representations. One is therefore faced with a non-intuitive ending in the underlying representations, since many Portuguese words end in -r, -s, and -z, and with a non-intuitive rule which must remove the non-intuitive underlying vowel, merely to save the generality of the statement that Portuguese words form their plurals merely by adding /-s/. From the standpoint of language acquisition, such an analysis is difficult to justify, since the child never hears the forms with the posited final /e/. It is therefore unlikely that he is going to analyze the forms in such a fashion, unless a strong motivation intervenes. The only motivation heretofore considered in earlier studies of the same problem is the generalization of the 'stress rule,' which, apart from being necessitated by certain proposed descriptions, appears to play no real part in the language.

Implicit in the generative analyses of Portuguese pluralization is the notion that the plural morpheme is adjoined to an abstract underlying form and that the resulting

underlying plural form then is passed through the ordered rules necessary to correctly derive the surface forms.

The observable data, however, indicate that the difference in the surface representations of the Portuguese plural forms is in itself a surface phenomenon; that is, that a plural ending is attached to an already existent surface representation of a singular form. It will be noticed that all plural forms end in the sequence [-cons] plus [s]. This ending may then be taken to be the canonical form of the plural marker in Portuguese, and all forms which are pluralized must be modified in order to fit this canonical form. In the case of the nouns of the above class II, which end in a consonant, it will be noticed in addition that Portuguese tolerates no final consonant clusters. Thus, the canonical form of the plural may be a result of this more general condition, since the plural forms of words in class II must be formed in such a way as to avoid final consonant clusters. Consequently, Portuguese speakers insert a vowel between the stem-final consonant and the plural morpheme. These observations point to a condition for insertion of the surface vowel [i] at the proper point in words of class II, in order that they may be pluralized in accordance with the general surface configurations of the language:

$$(17) \quad \emptyset \rightarrow \left[\begin{array}{c} \text{V} \\ +\text{high} \\ -\text{mid} \\ +\text{front} \end{array} \right] / \text{C} ______ + \text{s}\#$$

Mention must be made at this point of the exceptions to this statement, namely the words of class III ending in s

with unaccented final syllable. There is a very small number of such words in current use in the carioca dialect, at most five or six. Apparently, they all had regular plurals at one time, losing them by a process of haplology (cf. Williams 1962: 126). This is not a surprising development, since contemporary Brazilian Portuguese has evolved a stress accent so strong that final unaccented syllables are commonly lost in everyday speech. A final syllable of the form *sis would, under such circumstances, be extremely unlikely to survive. It is precisely due to this strong stress that words of class III do not take the expected plural ending, since it would not be pronounced in ordinary speech. Due to the fact that words of this class constitute a very small category, considered as somehow irregular by native speakers, it is quite unlikely that they undergo the regular process of pluralization together with a reduction of the difficult ending *Vsis, thus requiring a special additional rule (as suggested, for example, by St. Clair 1971). A hypothesis much more consistent with the observed data is that this extremely small class of forms is memorized as a list.

The next case to be examined is the above class IV of words ending in -l. Historically, this l was lost in intervocalic position when the regular plural ending es was added (cf. Williams 1962: 68-9). One might be tempted therefore to posit such a rule as being synchronically productive and accounting for the apparently irregular plurals of class IV (as does St. Clair 1971). Such a supposition

encounters two obstacles. The first is the large number of words in contemporary Portuguese which exhibit intervocalic l. The second is the fact that orthographic l in syllable-final is realized as the glide [w] in the carioca dialect. Since the orthographic ending -is of the plural forms of class IV contains the glide [j], this pluralization process appears to be merely a restriction to the front glide in plural forms ending in oral diphthongs:

(18) $\begin{bmatrix} -\text{cons} \\ -\text{voc} \\ -\text{nas} \end{bmatrix} \rightarrow \{\text{front}\} / \underline{\hspace{1cm}} + s\#$

The fact that word-final [w] of the singular forms in class IV derives from underlying /l/ seems crucial to the existence of such a condition, since the (extremely small) class of words ending in /Vu/ regularly forms its plurals in -s:

<u>pau</u>	'stick'
<u>paus</u>	'sticks'
<u>chapeu</u>	'hat'
<u>chapeus</u>	'hats'

Since the singular forms of both the above mentioned forms and the words of class IV end in [w] in the carioca dialect, the distinction as to the plural form can only be made by speakers aware of the spelling, or by speakers who have memorized the forms as a list. Mattoso Câmara (1957: 283) lists some of the confusions that result from this phonetic identity. Since the class of words ending in orthographic l is by far the larger of the two, plurals are leveled in favor of the ending in -is.

The analysis proposed above can also be made to include the case of words ending in accented -il, since Portuguese

contains no diphthongs both of whose elements are high and have the same front-to-back specification; i.e. *ij, *uw, etc. This fact may be made explicit in a reformulation of this phase of the pluralization process:

$$(19) \quad \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ -\text{nas} \end{bmatrix} \left\{ \begin{array}{c} [+ \text{front}] \\ \langle \emptyset \rangle \end{array} \right\} / \langle i \rangle ______ + s\#$$

As has been mentioned elsewhere in this study, the plural forms of words ending in unstressed -il are completely irregular and apparently cannot be predicted by either an abstract or a surface analysis.

The words of class V all end phonetically in a nasal diphthong. The plural ending s is therefore consistent with the established canonical pattern for Portuguese plurals, which is [-cons] plus [s]. The change from m to n in the plural is merely an orthographic convention, since these orthographic nasal consonants indicate nasalization of the preceding vowel.

The final case to be studied is the above class VI, of words ending in the nasal diphthong ǎo. To the extent that the plurals of these words conform to the canonical pattern, they are regular. As mentioned above, however, several recent analyses have attempted to derive these diphthongs from abstract underlying forms resembling the historical etyma with intervocalic n. It was mentioned at that point that any attempt at deriving surface nasal diphthongs from such underlying forms may only be made in a purely formal manner by utilizing a long series of rules. This is doubly true of the plurals of class VI. Although

the historical antecedents of these forms give a clue as to their present plural forms, there exists no synchronic means of predicting the plural form of a word ending in ão; these forms must be memorized alike by native speakers and foreign students. Deriving such forms from distinct and predictable underlying representations gives the appearance of a formal exercise carried to extreme, since, in the words of Malone (1970: 332);

the linguist must not attribute to a language more than its speakers can do.

Trying to predict forms which are beyond the ability of native speakers is too ambitious a goal for a linguistic investigation claiming to characterize the 'competence' of these speakers. These forms are historical residues, and synchronically they constitute one of the many idiosyncracies with which languages abound.

The preceding paragraphs have shown that the plurals of nouns and adjectives in Brazilian Portuguese may be grouped into two fundamental categories: those predictable by general rules, and a number of unexplainable exceptions. These exceptions, while conforming to the general surface canonical form of the Portuguese plural, cannot be derived in any regular way without resort to a large amount of unmotivated formal machinery in the form of highly abstract base forms and many ordered rules, all of which must be established solely to handle a relatively small class of words. These facts suggest, as was stated at the beginning of this section, that pluralization in Brazilian Portuguese is a

surface phenomenon explainable in terms of surface conditions and conforming to a general canonical pattern. There seems to be little need for the positing of abstract forms, since it is the surface constraints of the language which appear to dictate the form that will be assumed by the pluralized words.

FOOTNOTES

1. Kim (1971: 92) outlines some objections to the use of the same features for describing both vowels and consonants.
2. Although no accurate studies have been undertaken, a random count of 5,000 phonemes by Zipf and Rogers (1939: 127) shows [n] occurring about 10 times as often as [ɲ] and [l] as occurring about 4 times as often as [λ] .
3. If one chooses, as does the present investigation, to consider [x] and [r] to be variants of one and the same underlying representation, the naming of this underlying segment is quite arbitrary. The present investigation has chosen /x/ to represent the segment from which [x] and [r] are derived, partly due to the greater frequency of occurrence of [x].

CHAPTER SIX

CONCLUSIONS

The present investigation has proposed several theoretical hypotheses. The first, that phonological rules be considered not as a set of ordered rules leading from a highly abstract level of underlying representation to the surface phonetic level, but rather as a set of output constraints which may be applied simultaneously to a stored form in order to produce an acceptable surface manifestation. These constraints may be general to the language in question, or they may, in certain well-defined cases, be restricted to a specific class of forms. The only condition that must be met in all cases is that the proposed phonological description follow as closely as possible the observed data, which mirror the process of word production in native speakers of the language under consideration. In other words, the proposed linguistic description must actually be learnable by the native speaker given nothing more than the primary data and the ability to extract regularity from these data. By considering the surface forms of words to be produced by the simultaneous action of an unordered set of conditions on the surface form of an utterance, one can avoid the positing of the many phonetically unrealized forms which result from a set of strictly ordered rules. In this manner a description may be obtained which bears a close relation to the observed phenomenon of word production, which is an

instantaneous and generally unconscious process. Once freed from the encumbrance of a set of ordered rules, the description may proceed to investigate the manner in which words appear to be produced, a process which does not appear to be the result of a series of intermediate stages or successive revisions of the sort inherent in a system of extrinsically ordered rules.

The second theoretical proposition made in this study was the admission into the set of rules or constraints of rules stated in the form of transformations. It was pointed out that certain observed phenomena, while being manifested by a number of separate processes, appear to be the constituent parts of a single, unified process. Since the present study has considered that the most likely manner for phonological rules to apply to a form is as a simultaneous process, inherently unified phenomena, even those consisting of a number of component processes, should be described by a single condition. For this reason, transformational phonological rules, which may perform an arbitrary number of operations on any string conforming to the configuration of the structure indices, have been considered as the optimum form in which to express the output conditions proposed in the present study. Single rules will, if used to exclusion, lead to a single process' being described by a multitude of empirically meaningless individual stages.

During the course of the present investigation, no claim or proposal has been justified on purely formal grounds. It was mentioned in Chapter Two that formal decision procedures

founded on such principles as feature counting, such as the so-called 'simplicity metric,' appear to have no a priori connection with the simplicity or complexity of observed phonological processes. It was further mentioned in Chapter Three that the distinctive features chosen to serve in the present study were considered solely on the basis of descriptive accuracy, and were not motivated by considerations of the formal structure of the ensuing rules. At several points in this study, explicit mention was made of formal decision procedures, for the sake of completeness. Such references were not used as evidence or as counterevidence for the descriptions offered, but served merely to demonstrate the observable relation between purely formal methods of analysis and the techniques employed in this investigation.

Most of the theoretical issues raised in this study are contained in the phonological model of Derwing (in press), as described in Chapter Two. By applying Derwing's model to the data of Brazilian Portuguese phonology, it has been seen that the theory is consistent with the observed facts. The rules presented in the preceding chapters are, in the opinion of the present investigator, characteristic of spoken Brazilian Portuguese. These rules are formulated in such a fashion as to be learnable as true phonotactic generalizations by a child acquiring the language. While experimental work is needed to determine whether rules are actually acquired in the form presented in this study, it is nonetheless apparent that the rules proposed are both consistent with the data and reasonable as models of the learning process.

It has also been noticed in carrying out the investigation of Brazilian Portuguese phonology that there is evidently no need to posit extrinsically ordered rules. In fact, except in a few instances, there is no need for the proposed set of output constraints to apply more than once. Such an analysis lends strong empirical support to Derwing's proposed model, since, as mentioned previously, the data considered represent the bulk of Brazilian Portuguese word-level phonology.

Using the restrictions on the abstractness of lexical representations proposed by Derwing (in press), Kiparsky (1971) and others, has led to a further clarification of certain aspects of Brazilian Portuguese phonology. By restricting possible lexical representations to forms which may actually be perceived in a recognizable way by native speakers, one avoids the highly abstract forms and long string of rules claimed by recent generative phonological studies. In this way one restricts attention to what the speaker actually hears, and no attempt is made to link via a common underlying form words which may be totally unrelated in the mind of the speaker. Such a constraint also avoids considering alternations which are valid for only a small and often exceptional class of forms.

In Chapter Four, various phenomena involving oral vowels were examined. The largest part of the chapter was devoted to a detailed analysis of the process of unstressed vowel raising. It was found that in general, redundancy conditions describe this phenomenon, but that in cases where a shift of

stress causes a previously lower vowel to be raised in unstressed position, a further rule raising fully specified vowels must be considered active. It was demonstrated at that point that an abandonment of binary features in favor of an n-ary variable to describe degree of vocalic aperture resulted in a more natural and accurate description of the general process of unstressed vowel raising.

The next topic to be covered was the formation of glides. It was shown that glides may be derived from partially specified high, non-consonantal segments in unstressed position.

Epenthetic vowels, which may be predicted from their environments were next investigated. Since Portuguese prohibits initial sC sequences, and prohibits stops in word-final position, epenthetic vowels are introduced to break up these non-permissible sequences.

Chapter Three concluded with a brief discussion of vocalic variation in verb stems. It was asserted that, except for individual exceptions, Portuguese verb stem vocalic variations may be predicted within a given category by their surface structures. A sample analysis of a particular group of stem-changing verbs ensued, and a single condition was derived to describe this set of variations.

Various topics pertaining to the general phenomenon of vowel nasalization were discussed in Chapter Four. It was shown that many speakers of Brazilian Portuguese appear to analyze nasal vowels as a sequence of oral vowel plus nasal consonant. This statement was given further support by a discussion of the tendency to nasalize all vowels followed by

a nasal consonant, regardless of the syllabic structure. Nasal diphthongs were analyzed as a sequence of two non-consonantal segments followed by a nasal segment. It was mentioned at this point that the present-day Portuguese nasal diphthongs cannot be derived from underlying forms resembling their etyma in containing intervocalic /-n-/ without recourse to an extensive amount of purely formal and otherwise unmotivated rule structure.

The restriction of vowel nasalization to a subset of the Portuguese vowel system was considered as a general condition of vowel raising during nasalization. This condition operates only on the lower-mid and low vowels. Attention was then turned to the formation of a glide segment on word-final nasalized [ẽ] and [ẽ̃]. This was shown to be a general redundancy condition considered as a part of the general vowel nasalization process.

Chapter Four concluded with a description of vowel nasalization in Brazilian Portuguese in its most general form, that of nasalization by a contiguous nasal consonant, and proposed a single, multi-pronged condition which would account for all aspects of the vowel nasalization process.

Chapter Five was devoted to the description of the consonantal phenomena most characteristic of the carioca dialect. The first area of investigation was the palatalization of /t/ and /d/ before /i/. This was demonstrated to result from a two-stage redundancy condition, the second part of which is optional to carioca speakers.

The subject of the palatal resonants was next considered.

Data were presented which indicated that [ɲ] may be analyzed as /nj/ and that [λ] may be analyzed as /lj/ by many Brazilian speakers. A tentative condition was proposed which would derive the palatal resonants from two underlying segments in those cases where such an analysis seems justified.

The behavior of the syllable-final sibilants was considered next. The palatalization of /s/ in syllable-final position in the carioca dialect was shown to be an optional redundancy rule. The various voicing assimilations exhibited by /s/ were also examined, and were shown to be manifestations of a single process.

The behavior of /l/ was also considered. The vocalization of syllable-final /l/ in the carioca dialect may be considered, depending on the possibility of alternation, either as a redundancy condition, or as a phonological change rule.

The variation of [x] and [r] in intervocalic position were next described. Due to the restriction of [r] to intervocalic position, including across word boundaries and even morpheme boundaries, [r] was analyzed as the intervocalic variant of /x/. Intervocalic [x] was analyzed as /-xx-/, being reduced by a general degemination condition present in the language.

The last topic to be investigated was one which has inspired several generative phonological studies of Brazilian Portuguese, namely noun and adjective pluralization. Contrary to the assumption of previous studies that the plural morpheme /-s/ is attached to underlying singular forms, the discussion

in Chapter Five proposed that the pluralization process be considered as a surface phenomenon. It was noted that the canonical ending for a Portuguese plural is [-cons] plus s, and that the variation between plurals in -s and -es may be explained as the satisfying of this canonical pattern and as the breaking up of a non-permissable final consonant cluster.

The plural endings of nouns and adjectives ending in l were presented as a restriction to the oral glide [j] in most plural endings. The irregular plurals of words ending in unstressed -il were considered as general exceptions. Finally, all hope of deriving the irregular plurals of words ending in -ão from their Latin origins was abandoned as a result of the total synchronic unpredictability of these plural forms.

In summary, the present study has posed the question: are ordered rules and highly abstract base forms really necessary in the synchronic description of a language? The answer, for word-length Brazilian Portuguese phonology, appears to be no. Various topics, the sum total of which characterizes the majority of Brazilian Portuguese utterances, have been shown to result from general conditions on the language which determine the phonetic shape of emerging forms. The extent to which the methods employed in the present investigation may be applied to the study of other languages is not known at present. It must also be emphasized that a considerable amount of experimental testing must be effected in order to determine the actual validity of such an approach.

It is felt, however, that limiting the scope of phonological rules to eliminate the postulating of common underlying forms for widely divergent surface manifestations, and not attempting to put more into a description than the native speaker appears to put into his command of the language may lead to a simpler and hopefully more plausible general model of phonological processes.

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APPENDIX

A SUMMARY OF PROPOSED RULES

Throughout the course of this study, a number of conditions and descriptions were proposed, many of which had to be successively revised several times before they could be considered to present an adequate description of a particular phenomenon. The final form of all the rules or conditions proposed in the present study as being valid for the carioca dialect of Brazilian Portuguese are reproduced below in a labeled sequence.

Unstressed vowel raising

$$\left[\begin{array}{c} \text{V} \\ \alpha \text{ front} \\ -\alpha \text{ back} \\ -\text{stress} \end{array} \right] \rightarrow \left[\begin{array}{c} +\text{high} \\ -\text{mid} \end{array} \right]$$

$$\left[\begin{array}{c} \text{V} \\ -\text{front} \\ -\text{back} \\ -\text{stress} \end{array} \right] \rightarrow \left[\begin{array}{c} -\text{high} \\ +\text{mid} \end{array} \right]$$

$$\left[\begin{array}{c} \text{V} \\ n \text{ high} \\ -\text{stress} \end{array} \right] \rightarrow [n+1 \text{ high}] / \text{---} \left\{ \begin{array}{c} \text{V} \\ \langle +\text{high} \rangle \\ \langle -\text{mid} \rangle \\ \langle +\text{stress} \rangle \\ [-\text{cons}] \\ \# \end{array} \right\}$$

(1 ≤ n ≤ 3)

Glide formation

$$\left[\begin{array}{c} -\text{cons} \\ +\text{high} \\ -\text{stress} \end{array} \right] \rightarrow [-\text{voc}] / \left[\begin{array}{c} \text{V} \\ \langle +\text{high} \rangle \\ \langle -\text{mid} \rangle \\ \langle +\text{stress} \rangle \end{array} \right]$$

Epenthetic vowels

$$\emptyset \rightarrow \left[\begin{array}{c} \text{V} \\ +\text{high} \\ -\text{mid} \\ +\text{front} \end{array} \right] / \text{---} \# \left[\begin{array}{c} +\text{ant} \\ +\text{cor} \\ +\text{cont} \end{array} \right] \quad \text{C}$$

Palatalization of /n/ and /l/

$$\begin{array}{ccccc}
 \begin{bmatrix} -\text{cons} \\ \alpha \text{voc} \\ \alpha \text{cont} \\ -\alpha \text{nas} \\ +\text{cor} \end{bmatrix} & \begin{bmatrix} -\text{cons} \\ +\text{high} \\ +\text{front} \\ -\text{stress} \end{bmatrix} & V & \longrightarrow & \begin{bmatrix} -\text{ant} \\ +\text{cor} \\ +\text{high} \end{bmatrix} \quad \emptyset \quad 3 \\
 1 & 2 & 3 & & 1
 \end{array}$$

Voicing assimilation of /s/

$$\begin{bmatrix} +\text{ant} \\ +\text{cor} \\ +\text{cont} \end{bmatrix} \longrightarrow [\alpha \text{vce}] / V \text{_____} \left\{ \begin{array}{l} \langle \# \rangle \\ (\#) \end{array} \right\} \begin{bmatrix} \langle V \rangle \\ \alpha \text{vce} \end{bmatrix}$$

Palatalization of /s/

$$\begin{bmatrix} +\text{cor} \\ +\text{cont} \end{bmatrix} \longrightarrow \begin{bmatrix} -\text{ant} \\ \alpha \text{vce} \end{bmatrix} / \text{_____} \left\{ \begin{array}{l} (\#) \begin{bmatrix} c \\ \alpha \text{vce} \end{bmatrix} \\ \#\# \end{array} \right\}$$

Vocalization of /l/

$$\begin{bmatrix} +\text{cons} \\ +\text{voc} \\ -\text{ant} \end{bmatrix} \longrightarrow \begin{bmatrix} -\text{cons} \\ -\text{voc} \\ +\text{back} \end{bmatrix} / \text{_____} \left\{ \begin{array}{l} c_1 \\ \# \end{array} \right\}$$

Degemination

$$XX \longrightarrow X \quad \text{where } X \text{ is any segment}$$

Distribution of /x/

$$\begin{bmatrix} +\text{high} \\ +\text{back} \\ +\text{cont} \end{bmatrix} \longrightarrow \begin{bmatrix} +\text{voc} \\ -\text{high} \\ -\text{back} \\ -\text{cont} \end{bmatrix} / V \text{_____} (+)V$$

Plural formation

$$\begin{array}{l}
 \emptyset \longrightarrow \begin{bmatrix} V \\ +\text{high} \\ -\text{mid} \\ +\text{front} \end{bmatrix} / C \text{_____} + s\# \\
 \begin{bmatrix} -\text{voc} \\ -\text{cons} \\ -\text{nas} \end{bmatrix} \longrightarrow \begin{bmatrix} +\text{front} \\ \langle \emptyset \rangle \end{bmatrix} / \langle i \rangle \text{_____} + s\#
 \end{array}$$

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